A THEORETICAL MODEL OF GENERIC AND BRAND ADVERTISING

BY

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A theoretical model of generic and brand advertising has been developed in this study. The consumer, the recipient of advertising, maximizes utility from a commodity characteristic using the household production function approach. A commodity characteristic is produced by several inputs, including market products and generic and brand advertising. This approach provides an insight into how the consumer evaluates the informative and/or persuasive value of advertising. The advertising value reflects the different levels of product attributes, such as homogeneity, identifiability, nutritive characteristics, number of uses, presented on any market good. The level of the above product attributes is the differentiating factor between generic and brand advertising.

The producer, the supplier of advertising, enters the model as a profit maximizer who uses advertising up to the point where the marginal revenue product due to promotional efforts equals the marginal cost of

the advertisements. At the same time, market structural factors also affect the change in product price due to the use of advertising and are accounted for by the price elasticities of supply and demand.

The final form of the advertising model presented in this study has two equations in terms of advertising parameters and levels of generic and brand advertising expenditures. By varying the levels of the advertising parameters, this model was used to simulate and evaluate the effects of product attributes and structural factors on the levels of generic and brand advertising.

A general simulation of the advertising model shows that the level of a type of advertising with more favorable product attributes should have a larger share of the advertising market; the price elasticity of supply is directly related to the level of advertising; the price elasticity of demand is inversely related to the advertising level; the product price is directly related to advertising levels; and the knowledge of the product is inversely related to the levels of advertising. Further hypothetical simulation of the advertising model using beef, milk and potatoes confirmed the results obtained in the general simulation.

CHAPTER I

GENERIC AND BRAND ADVERTISING

Introduction

Advertising remains an important facilitator in the marketing of agricultural commodities. As part of the marketing process, it has also created considerable controversy for economists, marketers, policy-makers and the public in general. On one hand, advertising is perceived as being a source of factual information, thus facilitating the competitive nature of a product market. Conversely, advertising is said to be a source of misinformation, producing fancied differentiation of products, which in turn gives market power to the producers and thus potentially creates imperfect product markets. Researchers defending both sides of the argument have emerged, but no general consensus has evolved. Most probably these are the extremes of a range of situations where no clear delineation can be obtained because any case within this range may have characteristics to a certain degree common to both arguments.

Advertising in general has as a main goal to enhance the demand for a product. Producers (as advertisers) can pursue this goal via generic advertising whereby they actually cooperate and jointly promote a particular product. Alternatively, it is possible to indirectly increase the demand for a product through the use of brand advertising in which a particular producer or company promotes a brand with the

expectation of increasing its share of the market, thus eventually increasing the demand for the brand product. Generic advertising is generally seen as a provider of information since the advertisements of this type of promotion mostly emphasize the desirable attributes of a product, such as health benefits or other factual information which might not be available otherwise, or may be more expensive to obtain. Brand advertising, on the other hand, should be closely related to the market power theory because private labels are prone to include advertisement claims which are more difficult to validate, especially for those goods that have to be consumed to determine the validity of the advertisement claims (Ward, Chang and Thompson, 1985).

Generic promotion is the more obvious type of advertising playing the role of increasing the overall demand for the product group and not simply for one brand. An example is the increasing use of generic advertising by U.S. agricultural producers through federal programs. These producers, concerned with declining demands for some agricultural commodities and rising competition among food and non-food items quite noticeable in the late 1970s, have renewed interest in enhancing the demand for agricultural products through generic advertising. The United States food and fiber commodity groups, with approved individual federal acts, have steadily increase their total domestic generic advertising expenditures from $15.8 million dollars in 1974 (which included advertising for four products--wool, cotton, potatoes, and eggs) to $23.7 million dollars in 1980 and to $87.6 million dollars in 1984 (which included advertising for seven products--wool, cotton, potatoes, eggs, wheat, dairy, and tobacco).

Table 1.1 presents the different levels of generic advertising expenditures spent on several agricultural and animal products for selected years. Cotton was the most advertised product in 1974 with $9.4 million dollars (59.5 percent of total expenditures), while wool was the least advertised product with $0.6 million dollars (a share of only 3.8 percent). In 1984, advertising expenditures on dairy products accounted for $66.2 million dollars (75.57 percent of total advertising funds), while potatoes had a low of $1.7 million dollars (a share of only 1.99 percent).

By its nature, a generic promotional program needs a special arrangement for collecting funds to pay for the promotion. Currently, three major arrangements exist for funding generic advertising programs: voluntary associations, state-legislated programs and federal programs.

Morrison (1984) reported that voluntary associations are financing less than 15 percent of generic advertising and research programs.

State programs have been developed especially for those farm products not covered by federal programs and quite a few have been modeled after the Federal Agricultural Marketing Agreement Act of 1937.

Federal programs have evolved from voluntary associations with widely produced commodities, with the intent of expanding the geographic area of coverage and also to reduce or eliminate the free rider situation occurring under different forms of generic promotions. Free rider is defined as the enjoyment of a certain benefit without actually paying for it (Just, Hueth and Schmitz, 1982). The free rider situation occurs under voluntary agreements because payment is not

Table 1.1 Advertising Expenditures Under Research and Promotion Acts

Year	Products						Total
	Cotton	Dairy[a]	Eggs	Potatoes	Wheat[b]	Wool/ Lambs	
	---------- $1,000 ----------						
1974	9,400	-	4,200	1,600	-	600	15,800
1978	14,122	-	4,757	1,048	-	1,418	21,345
1980	15,885	-	4,346	1,632	-	1,826	23,689
1984/ 1985	13,747	66,226	3,027	1,749	-	2,886	87,635

[a]Collections started in Sept. 1984, under the Dairy and Tobacco Adjustment Act of 1983

[b]The Wheat and Wheat Foods and Research & Nutrition Education Act of 1977 does not authorize expenditures for promotion purposes

enforced, so the producer has the incentive of obtaining the advertising benefits without paying for them. This free rider condition relates also to the concept of a public good (Just, Hueth and Schmitz, 1982). A public good is one for which consumption by one individual does not prevent consumption by another individual. A slightly different definition which relates to production processes is that a firm may derive some benefit from the good without preventing another from enjoying the same benefit. A whole new set of research questions develops when generic advertising is examined as a public good.

National generic advertising programs can be classified into three groups: research and promotion acts, marketing orders, and joint promotion ventures for international market development through the Foreign Agriculture Service. Of these three programs, the federal government becomes a financing partner in the joint promotion ventures only. Research and promotion acts are federal legislation designed to provide some agricultural sectors with the authority to jointly support research and promote their products via a "check-off" program. Federal marketing orders fall under the Agricultural Marketing Agreement Act of 1937 and are quite broad in scope; they can directly or indirectly influence product quality and quantity and also provide for several market-support functions.

Even though the research and promotion acts and the marketing orders provide support for generic programs, it can be argued that the latter is of a less generic orientation. Marketing orders provide producers with collective control over specific marketing functions in a particular region only, while the promotion acts govern all regions but

are limited to research and promotion activities. The first agricultural commodity to obtain federal approval for generic promotion was wool, under the National Wool Act of 1954. After this product received federal approval, cotton, potatoes, eggs, beef, wheat and wheat foods, floral products, dairy and tobacco products, and honey followed in 1966, 1971, 1974, 1976, 1977, 1981, 1983, and 1984, respectively (Manley and Kenney, 1985).

In contrast, brand advertising is mainly financed by a private brand company and its function is explained through the two advertising mechanisms of persuasion and reinforcement (Sheth, 1974). Persuasion encourages consumers to choose among alternative brands within a given product category, and reinforcement continually directs the consumer's attention to a particular brand or product in order to achieve repeated purchases of that specific product. Thus brand advertising generally convinces the consumer to buy its own brand product by promoting some product attributes unique to the brand; that is, it promotes a differentiated product.

Product differentiation will occur when advertising is utilized as the conveyor of information of all real and fancied quality characteristics, such as taste, size, packaging, product appearance and other characteristics (e.g., nutritive properties) difficult to evaluate within a product category and/or among product groups. If advertising brings the consumer closer to understanding the true commodity characteristics, then this kind of advertising will be informative and any resulting market power is not from the advertising, but from the real differences within a product group. Otherwise, market

power will result from the advertising itself when the advertisements claim a fancied product characteristic such as a health-related attribute which is difficult to evaluate even with repeated purchases of the product. Ultimately, the success of advertising to attain product differentiation depends on both the actual product attributes and how easily these attributes can be measured. If concurrently generic advertising emphasizes certain attributes common to all brands within a product group, then brand advertising will likely decrease. One may even argue that generic promotions force brand advertisers to focus on those product attributes that are more difficult to directly evaluate; that is, to advertise product attributes that are less easily validated.

The linkage of generic and brand advertising with product differentiation also brings into the discussion the related factors of barriers to entry and economies of scale. Barriers to entry occur when existing firms have an economic advantage over potential entrants. Theoretically, such barriers are reflected by an entry forestalling price that exceeds the competitive price that would exist in the absence of entry barriers. If substantial advertising produces brand loyalty and if potential entrants must make considerable initial entry advertising and promotional expenditures, then advertising clearly leads to barriers to entry. The antithesis to these arguments is that advertising provides the medium for entry that could not occur otherwise. Barriers to entry are real. Whether advertising contributes to, or reduces such barriers becomes an empirical question. Advertising is used to create disloyalty more so than loyalty. Some evidence suggest that there is less consumer loyalty in the heavily

advertised markets. Also, the advertising intensity among the largest firms with major market shares is often less than for the smaller rivals. Still, there is empirical evidence showing increased advertising intensity as market shares rise (Ornstein, 1977). Generic promotions should result in much of the same conditions suggested above. Generic advertising efforts reduce barriers to entry since they are designed to expand aggregate demand and do not promote brand differences. Entry should be facilitated via generic advertising as long as potential entrants can supply the product attributes emphasized through generic messages. Thus consumers might gain from more competition among suppliers and relatively inexpensive product information sources; and producers might also benefit from expanding demand for their products.

Economies of scale occur when the advertising cost decreases on a per unit sales gain. Per unit cost may decline with the larger advertising commitments. Likewise, the sales gains may be proportionally greater with incremental increases in advertising. Theoretically, economies of scale give the larger firms an economic advantage over smaller firms and potential entrants. If there is some minimum threshold limit of exposure before consumers respond to advertising, then the larger advertisers can clearly have an advantage over smaller rivals. Likewise, if the larger media users can gain cost advantages, the potential entrants are at an initial disadvantage. Theoretically, existence of advantaged over disadvantaged firms translates into market power and higher prices (Bain, 1972). Still, additional empirical evidence is required to make more definitive

judgments about the existence of advertising economies of scale. The issue of scale economies is important to understanding the economics of brand advertising and its impact on suppliers' market shares. Yet, the generic promoter is competing with all other buyers for the optimal media time and space.

Brand advertising has remained a controversial subject. It can be both a source of market power when it differentiates a product through advertisements with fancied or real content, as well as a source of factual information that facilitates the competitive nature of a product market. Recent problems with declining demands and rising competition for a number of agricultural commodities have increased the need to use a relatively newer type of promotion. Generic advertising which promotes the overall attributes of a product market without specifying any brand in particular is also presently used in the marketing process. As a result, the evaluation of the potential consequences of advertising in the market for agricultural products is complex and difficult to determine.

The potential effects of advertising (both, generic and brand) on agricultural markets will depend on how advertising affects the consumer's utility function. Is advertising a source of information or persuasion? Answers to these questions will depend on the individual consumer, the particular structure of the product market (for both consumers and producers), and the particular attributes of the product under consideration. When brand and generic advertising are introduced jointly in the market, their potential consequences are more difficult

to determine because they generate separate, competitive, and complementary effects.

Problem Statement and Research Questions

Promotional programs have long been a part of marketing efforts to enhance the demand for agricultural products. Two major types of advertising can contribute to this promotional effort. Generic advertising is viewed as information that provides an inexpensive means for current and potential buyers to assimilate data about different products; thus the process should enhance competition. Brand advertising can be perceived as either a form of persuasion that creates product differentiation and thus leads to greater market power, or as a source of information through factual advertising.

Producers of agricultural products have been concerned with declining demands for some agricultural commodities. Rising competition among food and non-food items quite noticeable in the late 1970s has renewed interest in enhancing the demand for agricultural products through generic advertising. The United States food and fiber commodity groups have increased the expenditure level of generic advertising from $28.4 million dollars in 1972 to about $84.0 million dollars in 1982 (Morrison, 1984). These advertising expenditures are even greater now with the new dairy promotion programs of 1983, which accounted for approximately $68.0 million dollars in 1984. Beef and honey producers have recently passed the referendum to generically promote their product. The United States Department of Agriculture (USDA) is presently contemplating legislation of research and promotion acts for mushrooms and tropical fruits. All these actions are signs

that producers are increasingly expressing an interest in fully participating in the marketing function for their products.

Unfortunately, the presence of both generic and brand promotions in the agricultural markets makes the analysis of the advertising effects more difficult. A major portion of the empirical studies on advertising deals with either generic or brand advertising. And most have emphasized the effects of advertising on the producer (or marketer) side only. When studying advertising, many other economic issues come into play besides the costs or benefits accruing to the producer or marketer. It is also equally important to evaluate the effects of advertising from the consumer's perspective.

This study will develop a theoretical advertising model which includes generic and brand advertising and attempt to answer questions such as how both levels of advertising differ under a range of market conditions? What market conditions influence the performance of each type of promotion? What particular commodity attributes enhance the probability of success or failure of brand advertising, of generic promotions, and for both? What theoretical principles exist to give direction to both generic and brand advertising policies?

Objectives

The main objective of this study is to develop a general theoretical model of generic and brand advertising.

The specific objectives are

1. Identify the agricultural product characteristics and the structural market factors that regulate the range of effects of generic and brand advertising. These factors then provide the

basis for developing a theoretical framework for studying advertising.

2. Use the advertising model to simulate and determine the potential effects of generic and brand advertising on several agricultural commodities by varying the parameters representing the factors identified in objective 1.

3. Based on the results obtained in objective 2, develop a set of criteria that will help predict the performance (success) of current and new agricultural promotional efforts.

Methodology and Scope

This study will develop a theoretical model of generic and brand advertising using a household production function. It is assumed that the consumer tries to maximize utility, where utility is directly generated by the consumption of a commodity characteristic. This commodity characteristic is produced (through a household production function) by several inputs, among them the products bought in the market and the different types of advertising. Under the assumption of utility maximization, the optimal levels of market goods are obtained given the levels of both generic and brand advertising. Since these two types of advertising are also variables that can potentially change the optimal solution for the consumer, the model then shows what happens to the optimal solution when it is allowed to adjust to changes in generic and brand advertising, respectively. The producer enters into this model of advertising by assuming the role of the supplier of advertising. Then, the effect of generic and brand advertising in the product price not only depends on the agent who demands advertising, the

consumer, but also upon the agent who supplies advertising, the producer (where the name producer might also refer to a processor or advertising firm). A profit maximizer producer will use the level of advertising where the marginal revenue of each type of advertising equals the respective marginal cost. Furthermore, this advertising model is made operational by specifying a functional form of the consumer's demand for the commodity characteristic. With this primary demand on hand, the demand for the market product was derived. There were also determined specific functional forms for the supply of the market product and for the advertising function.

The final advertising model integrates not only the two major economic agents (the consumer and the supplier) of advertising, but also those factors that should have theoretically a definite impact in the level and efficiency of any type of advertising, such as the structure of the market and the product attributes. The market structure is introduced through the demand and supply elasticities. The attributes of the products are incorporated into the model using a specific advertising function.

The advertising model will then be used to show the general results of simulating different levels of product attributes and different levels of market structure for a product.

After this general simulation, the model will be applied to three agricultural products (beef, milk and potatoes), using mainly the nutritional attributes of the products as the base for comparison. The sensitivity of the model to different levels of product information and different ratios of generic and brand advertising will be also shown.

Finally, some general conclusions about generic and brand advertising, and agricultural products will be drawn.

Overview

A review of literature applicable and related to both generic and brand advertising, spanning from theoretical issues of advertising modeling to empirical work, is provided in Chapter II. The development of the theoretical model of generic and brand advertising is presented in Chapter III. In Chapter IV the product attributes and the market structural factors which are the major factors regulating the impact of advertising in the market are defined. Ranges of estimates for all advertising model parameters are also provided. Chapter V presents the use of the advertising model to simulate the impacts of different levels of product attributes and market structural factors on advertising levels of generic and brand advertising. Chapter VI covers the use of the advertising model to compare three agricultural products (beef, milk and potatoes) under different levels of market structures, product knowledge and nutritional attributes. Finally, Chapter VII serves to summarize, review conclusions and point toward avenues for future research.

CHAPTER II

REVIEW OF LITERATURE

Introduction

In this review of literature three topics related to promotions are covered: advertising and consumer goods, advertising and demand theory, and advertising and welfare theory. The section on advertising and consumer goods reviews different product classifications, and covers the following questions: Where do agricultural commodities fit in the different product classes? How does advertising (generic and brand) relate to the agricultural product class? The following section on advertising and demand theory covers the literature on the potential effects of advertising on consumers' tastes and preferences; the nature of the relationship of utility, advertising and demand; and a representative sample of demand studies evaluating advertising optimal use. The last section in this review of literature covers the relationship of welfare theory and advertising. This section is included because this research uses some instruments of welfare theory to build the advertising model.

Types of Advertising and Consumer Goods

Advertising tends to be more concentrated among consumer products than in producer goods because the clientele for consumer products are larger in number and more dispersed. Consumers demand information such as product alternatives, quality differences, prices, and product

reliability. Advertising can be one of the most effective means for filling this demand since it provides an inexpensive way for communicating with a large heterogeneous group of buyers. At the same time, it is possible that the advertisements do not provide factual information on the advertised products. Thus the consumers need to make adequate judgments about the informational content of the advertisements. This is true for both generic or brand advertising (Ward and Chang, 1985).

The importance of this type of information for the consumer is recognized by Nelson (1974). He classifies the products as search and experience goods. Search goods are those that consumers can inspect prior to purchase; they are bought very infrequently and are very expensive as to warrant considerable investment (including time) in acquiring information about the product. The experience goods are those that consumers actually have to consume in order to evaluate the positive attributes claimed in the advertisements, and they are relatively inexpensive. Agricultural food products fall in this latter category. Repeated purchases of the experience goods can help control deceptive advertising. Still, questions arise about how easy it is to validate advertising claims by the consumer.

Nelson further argues that the difference between the quality of advertising for search versus experience goods is so great that the advertising of experience goods is dominated by indirect information, while advertising for search goods is quite direct. That is, specific quality attributes are likely to be emphasized for the search goods; once these are known to the consumer, there is little incentive for the

advertiser to continue the advertisement. On the other hand, advertising for experience goods is directed towards achieving repeated purchases and employs methods to increase product awareness while providing less factual content about the product.

Porter (1976) developed a separate classification of the retail products into convenience and non-convenience goods, which complements Nelson's product grouping. Convenience goods are those sold through readily accessible outlets such as supermarkets and other retail chains. Retailers of convenience goods have little power to differentiate the product; if the manufacturer is successful in achieving differentiation, the manufacturer can increase factory prices and reduce the retailer's margin. Non-convenience goods are those sold in very specific outlets and they are not readily available for the consumers. For these non-convenience goods, the retailer is needed to provide information for obtaining product differentiation. Porter's model implies that either generic or brand advertising for the convenience group is designed to achieve high repeated purchases. The consumer of products sold through convenience outlets is swayed by relatively nonobjective advertising appeals, since the consumer is most unlikely to shop and expend information gathering outlays. The content of the advertising messages will be relatively less factual for convenience goods.

The advertising model to be developed in this study will be related to agricultural food products. Most agricultural commodities fall within the experience convenience category, especially when the product is transformed into foods and fibers purchased directly by the consumer. In fact, most commodities that are advertised under a cooperative

(generic) effort, such as dairy and citrus products, cotton, potatoes, eggs, wheat, lamb and wool, fall within the experience category.

Advertising and Demand Theory

Given that agricultural products are ultimately experience convenience goods, a fundamental question arises as to whether advertising (either generic or brand) affects the agricultural product demands. In other words, does advertising directly affect aggregate consumption or does it simply redistribute demand among brands within product groups?

There are few commodity studies addressing these questions. In a study of the milk industry, Thompson (1975) provides strong evidence that generic advertising increases aggregate demand or at least reduces the rate of decline in consumption. The empirical evidence for brand advertising effectiveness for the same commodity is limited. Ward, Chang and Thompson (1985) hypothesize that brand neutrality may not always hold if the generic message emphasizes the common characteristics within the product group, while the brand message stresses differences. This situation can be demonstrated with the case of advertising in Florida's citrus industry, where a few large orange processors attempt to achieve product differentiation while the generic message stresses the overall high quality of Florida's orange juice. Thus there can be both complementary as well as competitive effects of concurrent generic and brand promotions.

The effectiveness of generic advertising has also been studied in grapefruit and oranges. Gunter (1981) found that the use of generic advertising on fresh and processed grapefruit enhances the demand and

increases in on-tree returns. In the same study, it was estimated that an increase in per capita consumption of orange juice of .065 gallons was associated with a million dollar increase in advertising expenditures. Ward (1974) analyzed data of canned single-strength grapefruit juice and concluded that advertising is effective in increasing sales but effectiveness per dollar spent decreases as total advertising expenditure increases.

Since these empirical studies indicate that advertising affects the demand for agricultural products, the next logically related question is to ask, How does this happen? Most economists tend to agree that advertising has an impact on the demand for a product by changing the consumer's tastes and preferences.

Boynton and Schwendiman (1983) note that the precise mechanism by which taste and preferences are molded and consumption decisions altered falls largely within the domain of psychology and communications. Marrying ideas from these fields to economics might produce a comprehensive, testable theory of advertising and consumption.

Under the traditional theory of consumer behavior, where the consumer maximizes a utility function of goods and services bought in the market place subject to the available income budget, the consumer reaction towards advertising is explained by prices, income, and taste and preferences.

Michael and Becker (1973) found the use of the traditional theory of consumer behavior for advertising situations very limiting because of the lack of a good theory of taste formation. To develop a theory, these authors utilize the concept of the household production function,

where commodities are produced with the use of market goods, consumer's time, and advertising. Under their theory, the consumer's behavior was largely explained by prices and income, since tastes and preferences were assumed stable over time.

Another important issue related to advertising and the theory of demand is the nature of the relationship of advertising to the utility function. Does advertising produce utility directly or indirectly? Basman (1956) developed a model of consumer demand with variable preferences. Advertising does not enter the utility function directly. It rather works as a controller of a set of parameters which themselves determine the form of the utility function. Furthermore, Basman showed that his demand model yielded similar theoretical relations to those obtained under fixed preference demand models.

Lancaster (1971) developed a model of demand where utility is a function of product characteristics rather than products themselves. Kotowitz and Mathewson (1979a) utilize this product characteristics theory of demand in developing their dynamic model of consumer behavior. These authors emphasize that by placing advertising indirectly in the utility function through the product characteristics, the understanding of the role of advertising in the consumer's decision process is enhanced.

Dixit and Norman (1978), in another study of advertising, developed a static model of consumer demand where utility is a function of goods and any advertising of those goods. They argue that the inclusion of advertising in the utility function only shifts preferences and does not generate utility per se. Fisher and McGowan (1979) disagreed with the

Dixit and Norman model, claiming that once advertising is an argument of the utility function, then it is a direct generator of utility.

A recent theoretical model of advertising developed by Green (1985) uses dynamic utility functions. In this model, it is not clear how advertising enters the utility function. He uses the almost ideal demand system (AIDS) developed by Deaton and Muellbauer as the basic specification. The system AIDS is generated by a cost or expenditure function from which the shares of n different commodities are derived, and the advertising and its carryover effects are then specified in the parameters of the share functions.

Advertising and Welfare Theory

The controversial role of advertising as a source of information or as a source of persuasion can be also analyzed through the relationship of advertising to economic welfare. Issues relating to consumer welfare also directly depend on how advertising is treated in the utility function. Worcester (1978) provides a literature review on welfare losses to society. He explains that these welfare losses are products of excessive advertising which mainly creates monopoly power. Weckstein (1962) introduced an interesting theory which he called the aspiration-welfare function. Economic welfare depends not only on real income but also on the level of aspiration of real income. Economic welfare supposedly increases when real incomes rise or the level of aspiration declines. Advertising is viewed as a direct determinant of economic welfare through its impact on both the level of real income and the level of aspiration. Weckstein suggests that a welfare maximizing advertising level can be ascertained by estimating the aspiration and

real income functions for a population and then determining the advertising level for which the distance between the two functions is minimized.

In an model developed by Dixit and Norman (1978), advertising was introduced directly in the utility function and social welfare was analyzed under pre- and post-advertising market equilibria. Utility was a function of two goods (X and Y) and any advertising (Z) for those goods. The authors showed that if utility is given by the following function, U=U(X,Z/Y), welfare can be evaluated against a standard of judgment corresponding to the set of consumer tastes which occurs when advertising is at Z°. Keeping the standard of judgment fixed at Z° but allowing the actual level of advertising to vary, this study showed that welfare is reduced and advertising is excessive when judged by post-advertising tastes. Judged by pre-advertising tastes, advertising will never be a socially advantageous function unless the monopolist finds it profitable. Thus, their major finding is that the profit maximizing level of advertising is excessive under all product market structures. Dixit and Norman's work has been criticized by Fisher and McGowan (1979) who contended that the model provides no basis for comparing welfare when tastes change. This critique suggests that by allowing advertising to directly generate utility but fixing it at two levels, the authors failed to account for advertising's utility-generating properties.

Kotowitz and Mathewson (1979b) developed an advertising model in which advertising is not included in the utility function because such a specification offers no understanding of the role of advertising in the consumer's decision process. Furthermore, if advertising changes

consumers' tastes, it is not possible to evaluate the direct effects of advertising on consumers' welfare, because of a changing welfare yardstick. These authors specified quality-attribute expectations as the argument in the utility function. Utility from advertising is then derived indirectly from the consumer's improved perception of the product quality.

Finally, a study of consumer welfare and advertising by Nichols (1985) seems to be the least controversial and shows great potential for evaluating the relationship of utility functions, advertising, and consumer welfare. This author evaluated the consumer welfare consequences under equilibria levels of promotion by introducing advertising indirectly in the utility function. He used the household production function approach where a commodity characteristic is produced by market inputs, household time, advertising and other factors, thus converting the consumer into a dynamic producer of a commodity rather than a passive consumer of market goods. Nichols' main finding was that social welfare is related to the structure of the commodity and not to the structure of the market good.

CHAPTER III

ADVERTISING THEORY AND METHODOLOGY

Introduction

A model of advertising should consider and include all factors that theoretically affect its impact on consumer behavior and overall effectiveness, including structural adjustments. Major economic agents are the consumers and producers of advertisements.

The economic agents at the receiving end of the advertising flow are the consumers. They are the ones that need to evaluate the information provided by the advertisements. The advertisements can contain statements (information content) about a product that may or may not be difficult to evaluate. In this study, a consumer acquires information from advertising when the beliefs previously held by the consumer about a particular product (or brand of a product) change.

The economic agents on the supply side of the advertising flow may include the producers of the products, manufacturers of a single brand, processors of several brands of a product simultaneously, or marketers for the good. Due to the large variety of advertising suppliers, and to maintain the model within a manageable size, all the economic agents able to supply advertising for the consumers are categorized in this study under the name of "producers." This classification is particularly useful to the study since it emphasizes generic advertising, where producers actually fund the advertising programs.

Within these boundaries, the consumers on one side and the producers on the other, the impact of advertising on consumer behavior and effectiveness will differ because of

1. The type of advertising utilized; i.e., generic versus brand advertising.
2. The particular attributes of the advertised product. These product attributes are important factors interacting with advertising. Some of them will negate the effects of a particular type of advertising and others will help it in being successful.
3. The particular structure of the market. The structure of the market for an agricultural product will be important when studying the effects of any type of advertising. Product differentiation, barriers to entry, and scale economies are major factors regulating the intensity and level of advertising in the markets, and the final performance of advertising.

Consumer, Advertising and Utility Theory

Utility theory has long been used as the theoretical construct representing the preferences of an individual consumer. Consumer's behavior is reflected in the market by the consumer's demand. A system of demand equations showing the consumer's behavior is normally obtained by assuming the consumer is rational and tries to maximize the utility function subject to the available budget income. The main role of advertising is to enhance the demand for a product by influencing the consumer's consumption behavior. These consumption patterns, and

therefore the system of demand equations and what they look like, are in part a reflection of how advertising enters the consumer's utility function. An important question is whether consumers directly receive utility from the advertising. Does the advertising message by itself have some entertainment value or does utility result from what is being achieved with the advertising? Thus, important theoretical issues arise from the relationship implied between advertising and the underpinning utility function. What arguments should be included in the utility function? Can goods and advertising be mixed in the same utility function? What are the consequences of doing this?

Michael and Becker (1973) found that the traditional theory of consumer behavior, where the consumer maximizes a utility function of goods and services bought in the market subject to the available income budget, was not adequate for handling several categories of consumer behavior, such as addiction, custom, tradition, fashion and fad, and advertising. The traditional theory of consumer behavior is criticized in that by default the categories of observed behavior mentioned above are to be explained with variations of tastes. In other words, to whatever extent income and prices do not explain observed behavior, the explanation rests with changes in tastes since taste is the last remaining argument in the demand function. These authors found this situation very disturbing, primarily because neither economists nor other social scientists have a useful theory of the formation of tastes. How can the economists rely on differences in tastes to explain certain observed consumer behavior when it cannot be explained how tastes are formed, nor predict their overall effects. Stigler and Becker (1977)

proceeded to formulate a consumer's theory of choice in a format more suitable for analysis of many categories of consumer behavior without being restrained by the assumption that tastes remain the same. The central idea of this formulation was the household production function approach. This approach views as the primary objects of consumer choice various entities, called commodities, from which utility is directly obtained. These commodities are produced in the household by combining the goods purchased in the market, the household's own time, the skills, training, other human capital, and other inputs. In this framework, the household demand for the market goods is a derived demand similar to the derived demand by a firm for any factor of production.

An example of a commodity under this approach would be a regular household supper. This commodity (the supper) is the actual generator of utility and it is produced with all the ingredients utilized in preparing the supper, the time needed for preparation, and the skills of the cook who prepared it. Moreover, in this approach it is argued that the ingredients bought in the market and the time utilized for preparing it have no direct utility value for the consumer until they are transformed through the production process into a supper (the final commodity).

Formally, the household's utility function is defined as

$$U = \mu(Z_1, Z_2, \ldots, Z_n),$$

where Z_i represents the i^{th} commodity set of characteristics. Each commodity set is produced by the household using market goods and its own time,

$$Z_i = z_i(X_i, t_i, Y_i, E),$$

where X_i is the i^{th} good bought in the market; t_i is the household own time; Y_i represents other inputs; and E represents the environmental variables such as the state of the art in production, or the level of technology of the production process.

The household is assumed to maximize the utility function subject to two constraints--the household's available time and income,

$$T = t_w + \sum_i^n t_i \quad ,$$

where t_w is the labor working time, t_i is the time producing Z_i, and T is the total available time; and,

$$I = \sum_i^n P_i X_i \quad ,$$

where P_i is the i^{th} good price and I is the money income.
The time and money income can be combined into a household's full income, S:

$$S = w T + V = \sum_i^n (w t_i + P_i X_i),$$

where w is the wage rate, assumed to be constant; and V is the household's non-wage income.
Using the Lagrangean function to maximize the utility subject to these constraints yields

$$L = \mu(Z_1, Z_2, \ldots, Z_n) - k\left(\sum_{i}^{n} (w\, t_i + P_i\, X_i) - S^*\right),$$

where the ratio of the first order conditions with respect to the i and j commodities is

$$\frac{MU_i}{MU_j} = \frac{w(\partial t_i/\partial Z_i) + P_i(\partial X_i/\partial Z_i)}{w(\partial t_j/\partial Z_j) + P_j(\partial X_j/\partial Z_j)} = \frac{P_{z_i}}{P_{z_j}};$$

i.e., the ratio of the marginal utilities of any two commodities, Z_i and Z_j, must equal the ratio of their marginal costs, with P_{z_i}/P_{z_j} (the shadow prices of the Zs) determined by the prices of market goods, time, and by the productivity of each in the production of the Zs.

Similarly, differentiating the Lagrangean function with respect to all factors of production, to determine their optimal use, gives

$$\frac{(\partial U/\partial Z_i)(\partial Z_i/\partial f_{ik})}{(\partial U/\partial Z_j)(\partial Z_j/\partial f_{jl})} = \frac{(MU_i)(MP_{ik})}{(MU_j)(MP_{jl})} = \frac{P_{f_{ik}}}{P_{f_{jl}}};$$

i.e., the optimal factor use is obtained when the ratio of the marginal products is equal to the ratio of the factor prices. The Zs have no market prices because they are not purchased or sold in the market and are instead consumed within the household; but the Zs do have "shadow prices" determined primarily by production costs. Stigler and Becker show that if the Z_i (production function) is homogeneous of the first degree in the inputs X_i and t_i, the marginal and average costs would be the same and the shadow price for Z_i would be

$$P_{z_i} = \sum_{j=1}^{k} a_{ji} [(P/w_1), (w/w_1), Y_i, E] P_j$$

$$+ \sum_{j=1}^{l} b_{ji} [(P/w_1), (w/w_1), Y_i, E] w_j ,$$

where w_1 is a price deflator. These equations show all the numerous and varied determinants of the shadow prices and observe all the "subtle" forms that prices can take in explaining differences among men and periods.

This type of approach has been largely applied for behavior analysis in travel, marriage, education, fertility, migration, health, life cycle patterns, etc. Advantages of this formulation are several. Without producing conflict with the traditional consumption theory (both formulations can be used for many categories of behavior), the household production function approach gives more emphasis to changes of relative prices and income, and less to changes in tastes for interpreting behavior. Thus, more insights can be gained when evaluating the consumption process, which also makes the economic analysis more amenable. It can be added that since the formulation makes use of production functions, an already well-developed theory of production will be available if needed.

Formulation of Consumer Choice and Advertising

Advertising is one of the more obvious categories of consumer behavior where changes of perceptions are invoked as an explanation for economic phenomena. It assumes the advertiser tries to persuade the consumer to prefer a particular product or product brand.

Under this formulation, it is not necessary to attribute to advertising the function of changing tastes. Instead it is assumed that the consumer indirectly receives utility from a market good. This utility depends not only on the quantity of the good, but also on the consumer's knowledge of its true or alleged properties; e.g., oranges are consumed because they are food, non-poisonous and a good source of vitamin C. This knowledge of the attributes of the market goods will be one of the inputs entering into the household's production function together with the quantities of the goods purchased in the market, and other inputs.

Advertising is introduced by assuming that the input knowledge, whether real or fancied, is provided by the advertising of the market good. The implications of analyzing advertising under this formulation are presented through a particular case where the output ($\underline{X}$) of a particular firm and its advertising (D) are the inputs into a commodity (Z) produced and consumed by a household.

Stigler and Becker (1977) define the following household utility function:

$$U = \mu(Z, \underline{Y}),$$

where $Z = g(D)\ X$; $(\partial Z/\partial \underline{X}) > 0$; $(\partial Z/\partial D) > 0$; $(\partial g/\partial D) > 0$; $(\partial^2 g/\partial D^2) < 0$; Z is the consumed set of characteristics; g(D) is an advertising function representing the informational effect on consumers' perception of the attributes of $\underline{X}$; $\underline{Y}$ summarizes all non-advertised goods; D is a type of advertising; and $\underline{X}$ is the advertised market product.

In this study, it will be argued that the homogeneity assumption for Z related to $\underline{X}$ is restrictive and quite unrealistic, and a more general relationship between these two variables will be developed later when formulating the consumer's model with both generic and brand advertising.

Assuming the household tries to maximizes its utility and that the advertising reaching any household is independent of the consumer's behavior, form the Lagrangean,

$$L = \mu(Z,\underline{Y}) + k(I-P_x \underline{X}-P_y \underline{Y}),$$

where I is the budget income, and P_x and P_y are the prices of $\underline{X}$ and $\underline{Y}$, respectively.

Substituting Z with the consumer's production function, g(D), gives

$$L = \mu(g(D) \underline{X}, \underline{Y}) + k(I-P_x \underline{X}-P_y \underline{Y}),$$

and obtaining the first order condition with respect to $\underline{X}$:

$$(\partial\mu/\partial Z)(\partial Z/\partial \underline{X}) - k P_x = 0,$$

$$(\partial\mu/\partial Z)\ g(D) - k P_x = 0,$$

$$(\partial\mu/\partial Z)/k = (P_x/g(D)),$$

where $(\partial\mu/\partial Z)/k$ is interpreted as the shadow price for the commodity characteristic, P_z. Thus, $P_z = P_x/g(D)$, given $Z=(g(D))\ \underline{X}$.

The shadow price of Z, P_z, is the expenditure on $\underline{X}$ required to change Z by one unit. It is important to note that the output price P_x

is not the only factor capable of changing the commodity price, P_z. An increase in advertising (through g) can also lower the commodity price for the household, which increases the demand for the commodity and also produces an increase in the demand for the firm's output. Advertising does not change the taste for the product, but changes the consumers' perceptions of the attributes associated with consuming $\underline{X}$.

A Model of Generic and Brand Advertising

A model of the consumer's approach to generic and brand advertising will be based on the framework developed by Stigler and Becker (1977) and recent work by Nichols (1985) on advertising and welfare. Suppose there are only two types of goods in the market, say $\underline{X}$ and $\underline{Y}$, where $\underline{X}$ is the advertised experience good and $\underline{Y}$ represents other non-advertised goods. For example, $\underline{X}$ may be a basic food item such as a dairy product, or a vegetable. This product goes through several stages of perceived transformations before reaching the consumer. In such case, the consumer actually purchases Z_i, where Z_i is the commodity characteristic that corresponds to $\underline{X}$ after the consumer is told about the attributes (real or fancied) of the good $\underline{X}$. The human capital and time factors, normally presented in a household production function, are excluded in this model to concentrate in the analysis of the advertising factor. Also, all variables included in the formulation of the advertising model should be treated as scalars.

The consumer is assumed to have a utility function for goods Z_i and Z_j:

$$U = \mu(Z_i, Z_j),$$

where $Z_i = \underline{X}^g$; $Z_j = \underline{Y}$; $g = f(A,B)$ and $0<g<1$; A is generic advertising; B is brand advertising; g is the advertising function; $\underline{X}$ is the advertised market good; $\underline{Y}$ represents all other non-advertised market goods; Z_i is the commodity characteristic produced entirely with $\underline{X}$; and Z_j is the commodity characteristic produced entirely with $\underline{Y}$. Note that Z_i is implicitly assumed to be a scalar transformation of $\underline{X}$ since these two variables should be measured in different units. Similarly, Z_j is normalized on some scalar adjustment with respect to $\underline{Y}$.

The commodity characteristic Z_i is produced by the consumer using the market good $\underline{X}$ and the information received through the generic and brand advertising, A and B, respectively. The consumer is not only buying $\underline{X}$ but also all of those perceived attributes associated with what is being conveyed through the advertising function g(A,B). In fact, the consumer is actually consuming Z_i, the commodity characteristic. Thus, advertising affects the utility for Z_i indirectly through the market good $\underline{X}$.

The Z_i-$\underline{X}$ Linkage

Here, a digression is necessary to explain why the particular functional form $Z_i = \underline{X}^g$ was selected for the linkage between Z_i and $\underline{X}$, instead of the form $Z_i = g\,\underline{X}$ utilized by Stigler and Becker, and Nichols.

This particular functional form was chosen to represent the consumer's production function for the following reason: the commodity characteristic, Z_i, is produced by several inputs, among them the market product $\underline{X}$ and advertising. Advertising (either generic or brand) contributes to the production of Z_i through the advertising

function g. Theoretically, the impact of A or B in the production of Z_i not only depends on the particular form of g, but also on the amount of $\underline{X}$ being bought in the market to produce the commodity characteristic Z_i. That is, the effects of generic and brand advertising in the production of the commodity characteristic by the consumer should differ, when a certain (fixed) amount of advertising is used by a consumer under two different levels of consumption of $\underline{X}$. For example, since agricultural products are considered experience goods, it should be expected that the more of the agricultural product bought in the market (to produce the Z_i commodity), the less likely for the advertisements to be able to change previous perceptions of agricultural products by the consumer. This difference in effect is accounted for in the model by using $\underline{X}$ as the base of the exponential function.

For example, consider the consumption of artificial sweeteners. Through advertising, the consumer's perceptions and awareness are changed, thus potentially increasing the consumption of Z_i and, subsequently, that of $\underline{X}$, the sweetener. Now if advertising is fixed at some level and the consumption of $\underline{X}$ is double, the levels of sweeteners perceived will not necessarily be double. Some Z_i characteristics may increase in direct proportion to $\underline{X}$ while others will not, especially those based on perceptions. Note that the evaluation here is about perceptions and not the utility derived from the commodity characteristic. Another example may be that certain goods are consumed because of the snob appeal. Doubling the consumption of $\underline{X}$ does not double the snob perception of the advertised product. For these reasons, the Z_i-$\underline{X}$ linkage must be expressed in a more flexible form

allowing for the declining marginal perception levels. Convenience may be another Z_i characteristic contributing to similar non-proportional argument.

Figure 3.1 illustrates a theoretical Z_i response over a range of $\underline{X}$ and g. While $Z_i=\underline{X}^g$ is specified, it is assumed that Z_i is normalized on some scale adjustment with respect to r. That is, Z_i does not necessarily equal $\underline{X}$ when, say, g=1. Rather, $Z_i=r\ \underline{X}^g$, since Z_i, the actual characteristic set, is in units different from $\underline{X}$. In this case, the scalar r provides the scale linkage between $\underline{X}$ and Z_i. Without any loss of generality, Z_i is defined as Z_i/r and hence $Z_i=\underline{X}^g$.

The constraint $0<g<1$ is included in this particular case to complement the reason given for choosing the form $Z_i=\underline{X}^g$ above. It is assumed that the consumer learns from previous experiences, and once the consumer knows the basic facts of any agricultural product, the more difficult it is for any advertiser to provide information (either real or fancied) to the consumer. Thus, if g is constrained to be greater than 0 and less than 1, then in fact it says that as more and more $\underline{X}$ is bought in the market, the marginal productivity of using $\underline{X}$ to generate Z_i increases at a decreasing rate; that is, $(\partial Z_i/\partial \underline{X})>0$ and $(\partial^2 Z_i/\partial \underline{X}^2)<0$.

As indicated earlier, advertising has historically been discussed in the context of two major conflicting functions. One argument is that advertising is a form of "persuasion" that creates product differentiation and thus leads to greater market power among those with significant advertising efforts. This gain in power is at the expense of the consumer primarily because of price increases. Alternatively,

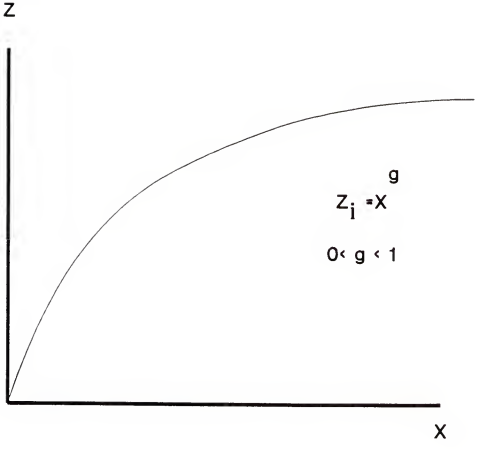

Figure 3.1 A Functional Form $Z_I = X^B$ for Advertising

advertising is viewed as "information" that provides an inexpensive means for current and potential buyers to assimilate knowledge about different products. Thus, this latter effort should enhance competition and reduce barriers to entry. Advertising may be introduced in the market through a cooperative effort among producers with a common interest to promote consumption of the general product via generic advertising. But efforts may be also directed to disseminate information about the particular attributes of a given brand of a product.

The four mechanisms through which advertising works (Sheth, 1974)--precipitation, persuasion, reinforcement, and reminder--provide an initial distinction between generic and brand advertising. Generic advertising is intended to precipitate and remind, while brand advertising is primarily intended to persuade and reinforce. The functions of precipitation and reminder are more likely to increase total industry sales, while persuasion and reinforcement are usually associated with maintaining or increasing market shares.

In every case, the effects of the advertising relate to how each of these mechanisms brings about changes in the economic system. These changes include adjustments in consumer behavior and product preference that in turn contribute to structural adjustments over time. For example, market shares may increase (decrease), price may rise (fall), or market power may increase (fall). Since generic and brand advertising contribute to the transformation from $\underline{X}$ to Z_i, then their individual contribution and their particular interaction will provide the fundamental distinction between the kind of messages conveyed to the

consumer (i.e., on which of the above-mentioned mechanisms will prevail) and how they (generic and brand advertising) will ultimately impact the demand for the advertised product, $\underline{X}$, and the economic system. Furthermore, the same effort may succeed for one product and have less success for another simply because of specific attributes of the product and particular structure of the product market.

Maximizing Utility

Substituting $\underline{X}^E$ for Z_i and $\underline{Y}$ for Z_j in the utility function, one obtains the utility specification in terms of the observed advertised and non-advertised market products,

$$U = \mu(\underline{X}^E, \underline{Y});$$

and, assuming the consumer maximizes the utility function subject to a budget constraint yields

$$\text{Maximize } U = \mu(\underline{X}^E, \underline{Y}),$$

subject to,

$$P_X \underline{X} + P_y \underline{Y} = I \text{ and } g = f(A,B),$$

where I is the consumer's available income, P_X is the price of $\underline{X}$, and P_y is the price of $\underline{Y}$.

Solving this constrained optimization problem for $\underline{X}$ and $\underline{Y}$ using the Lagrangean function,

$$L = \mu(\underline{X}^E, \underline{Y}) + k(I - P_X \underline{X} - P_y \underline{Y}),$$

where L is the Lagrangean function and k is the Lagrangean multiplier to be interpreted as the marginal utility of money income.

The first order condition for this problem with respect to $\underline{X}$ is

$$(\partial L/\partial \underline{X}) = (\partial U/\partial Z_i)(\partial Z_i/\partial \underline{X}) - k(\partial P_x \underline{X}/\partial \underline{X}) = 0,$$

$$(\partial L/\partial \underline{X}) = U_z \; g \; \underline{X}^{(g-1)} - k \; P_x = 0,$$

$$U_z \; g \; \underline{X}^{(g-1)} = k \; P_x.$$

Thus,

$$(1) \qquad (U_z/k) = (P_x \; / \; (g \; \underline{X}^{(g-1)})) = P_z,$$

where $U_z = (\partial U/\partial Z_i)$; and $g \; \underline{X}^{(g-1)} = (\partial Z_i/\partial \underline{X})$.

The ratio U_z/k is the shadow price of the commodity characteristic, or P_z; and represents the utility generated by spending one additional money unit on Z_i. The shadow price P_z is affected not only by the price of the advertised product P_x but also by the amount of $\underline{X}$ bought in the market, the generic and/or brand advertising through the advertising function g, and the interaction of the type of advertising with the quantity of the advertised product.

Utility adjustments from the non-advertised good $\underline{Y}$ follow where

$$(\partial L/\partial \underline{Y}) = (\partial U/\partial \underline{Y}) - k(\partial P_y \; \underline{Y}/\partial \underline{Y}) = 0,$$

$$(\partial L/\partial \underline{Y}) = U_y - k \; P_y = 0,$$

$$U_y = k \; P_y.$$

Thus,

(2) $(U_y/k) = P_y$,

where $U_y = (\partial U/\partial \underline{Y})$.

As in equation (1), U_y/k can be interpreted as the shadow price of the product $\underline{Y}$. But in this case, since $\underline{Y}$ is a non-advertised product, its shadow price is equal to the product price paid in the market, P_y.

Finally, the utility adjustments with respect to k yield

$$(\partial L/\partial k) = (\partial L(I-P_x \underline{X}-P_y \underline{Y})/\partial k) = 0,$$

$$(\partial L/\partial K) = I - P_x \underline{X} - P_y \underline{Y} = 0.$$

Thus,

(3) $I = P_x \underline{X} + P_y \underline{Y}$.

This last first order condition states that the available income has to be equal to the total expenditures on $\underline{X}$ and $\underline{Y}$.

From these first order conditions, the values of $\underline{X}$, $\underline{Y}$ and k that maximize the consumer's utility are obtained,

X, Y, and k.

If the second order conditions also hold (conventional assumption that U is strictly quasiconcave) it is known that X, Y, and k maximize the consumer's utility given the level of advertising (Nichols, 1985); that is:

(4) $U = \mu(X^E, Y)$,

and income is allocated, such that

(5) $I = P_x X + P_y Y$.

Utility Response to Advertising

Up to this point, the consumer's model of advertising presents the optimal amounts, X and Y, that maximize the consumer's utility. The levels of generic (A) and brand advertising (B) are assumed given. Note from the above derivation of utility maximization that the demand for the market good X is a derived demand from the consumer's primary demand for Z_i. The demand for Z_i is a primary demand in the sense of being the direct generator of utility to the consumer. The demand for X is a derived demand because it is obtained from the demand for the primary good, the commodity characteristic Z_i. At the same time, the first order conditions derived from the consumer's utility maximizing problem show that P_x is not the only factor contributing to the shadow price of the primary commodity Z_i. Both types of advertising, A and B, through the advertising function, affect the shadow price for Z_i.

Under the assumption of perfect competition in the market for the commodity characteristic, Z_i can be indirectly supplied by many producers even though few actual producers supply the same market product, X. Therefore, a producer could (indirectly) supply an unlimited quantity of the commodity characteristic at a fixed price. If the level of advertising is given, P_z would have one to one correspondence with P_x (see equation (1)). However, if the level of advertising is also a variable, the producer could sell X at different prices by varying the level of advertising. This occurs because an increase in advertising would increase the output of the commodity characteristic that the consumer receives from a given amount of the

market product, therefore increasing P_x relative to the fixed competitive price for P_z.

Thus, if profits are assumed to be maximized by firms' advertising choices, the effect of advertising on consumer welfare may be inferred by differentiating consumer's surplus with respect to advertising and evaluating this derivative at the profit maximizing level of advertising.

First, differentiating equation (4) with respect to generic advertising yields

$$(6) \quad (\partial U/\partial A) = U_z(\partial Z_i/\partial A) + U_y(\partial Y/\partial A),$$

where $(\partial Z_i/\partial A) = (\partial X^g/\partial A)$.

If X^g is transformed to logarithms, the differentiation with respect to A is simplified:

$$(\log X^g) = g\ (\log X),$$

$$(1/X^g)(\partial X^g/\partial A) = g\ (\partial(\log X)/\partial A) + (\log X)\ (\partial g/\partial A),$$

$$(1/X^g)(\partial X^g/\partial A) = g\ (1/X)(\partial X/\partial A) + (\log X)\ (\partial g/\partial A),$$

$$(7) \quad (\partial X^g/\partial A) = g\ X^{(g-1)}(\partial X/\partial A) + X^g\ (\log X)\ (\partial g/\partial A).$$

Substituting this expression for $(\partial Z_i/\partial A)$ in equation (6) gives

$$(8) \quad (\partial U/\partial A) = U_z\ (g\ X^{(g-1)}\ X_a + X^g\ (\log X)\ g_a) + U_y\ Y_a\ ,$$

where $X_a = (\partial X/\partial A)$, $g_a = (\partial g/\partial A)$, and $Y_a = (\partial Y/\partial A)$.

Substituting for U_z and U_y using the derived first order conditions from equations (1) and (2) yields

$$(\partial U/\partial A) = k(P_x X/g X^g)\{g X^{(g-1)} X_a + X^g(\log X)g_a\} + k P_y Y_a,$$

$$(9) \quad (\partial U/\partial A) = k\{(\log X) P_x X (g_a/g) + P_x X_a + P_y Y_a\}.$$

To include the effects of the adjustments of A on the income constraint, differentiating equation (5) with respect to generic advertising, A, (Nichols, 1985):

$$(\partial I/\partial A) = P_x(\partial X/\partial A) + X(\partial P_x/\partial A) + P_y(\partial Y/\partial A) = 0,$$

$$(10) \quad P_x X_a + P_y Y_a = -X (\partial P_x/\partial A),$$

and incorporating this result in equation (9), yields the following utility adjustment to changes in A:

$$(\partial U/\partial A) = k \{P_x X (\log X)(g_a/g) - X(\partial P_x/\partial A)\},$$

$$(11) \quad (\partial U/\partial A)/k = \{P_x X (\log X)(g_a/g) - X(\partial P_x/\partial A)\}.$$

Equation (11) represents the implicit price for A and can be expressed in terms of elasticities:

$$(12) \quad (\partial U/\partial A)/k = \{(P_x X)/A\} \{(\log X) E_{ga} - E_{p_x a}\},$$

where $E_{ga} = (\partial g/\partial A)(A/g)$, $E_{p_x a} = (\partial P_x/\partial A)(A/P_x)$.

The expression for E_{ga} is a technical relationship reflecting the relative effects of generic advertising on the commodity characteristic Z_i through the advertising function g. The expression for $E_{p_x a}$ is not

immediately calculated but does reflect how prices of the base good X must change since A leads to changes in the derived demand for X.

Generic advertising is not the only factor affecting P_z through the advertising function. Brand advertising is the other type of promotion that can affect P_z, and by a chain response will also impact P_x. The major difference between generic and brand advertising is that the former is designed to achieve market expansion for both processed and fresh agricultural products. While the latter may expand the total market, its programs are designed specifically to meet the particular firm's overall marketing objectives (Ward, Thompson and Armbruster, 1983).

Differentiating equation (4) with respect to brand advertising, B, gives

$$(13) \quad (\partial U/\partial B) = U_z\,(\partial Z_i/\partial B) + U_y\,(\partial Y/\partial B),$$

where $(\partial Z_i/\partial B) = (\partial X^g/\partial B)$.
As before, the transformation of X^g to logarithms yields

$$(\log X^g) = g\,(\log X),$$

$$(1/X^g)(\partial X^g/\partial B) = g\,(\partial(\log X)/\partial B) + (\log X)(\partial g/\partial B),$$

$$(1/X^g)(\partial X^g/\partial B) = g\,(1/X)(\partial X/\partial B) + (\log X)(\partial g/\partial B),$$

or

$$(14) \quad (\partial X^g/\partial B) = g\,X^{(g-1)}\,(\partial X/\partial B) + X^g\,(\log X)(\partial g/\partial B).$$

Substituting this expression for $(\partial Z_i/\partial B)$ back into equation (13) gives

$$(15)\quad (\partial U/\partial B) = U_z \{g\, X^{(g-1)}\, X_b + X^g\, (\log X)\, g_b\} + U_y\, (\partial Y/\partial B),$$

where $X_b = (\partial X/\partial B)$, $g_b = (\partial g/\partial B)$.

Substituting U_z and U_y with the derived first order conditions from the consumer's utility maximizing problem (equations (1) and (2)) yields

$$(\partial U/\partial B) = k\, (P_x\, X)/(g\, X^g)\{g\, X^{(g-1)}\, X_b + X^g\, (\log X)\, g_b\}$$

$$+ k\, P_y\, Y_b,$$

$$(16)\quad (\partial U/\partial B) = k\, \{P_x\, X\, (g_b/g)(\log X) + P_x\, X_b + P_y\, Y_b\}.$$

To include the effects of the adjustments of B on the income constraint, differentiate equation (5) with respect to brand advertising B:

$$(\partial I/\partial B) = P_x\, (\partial X/\partial B) + X\, (\partial P_x/\partial B) + P_y\, (\partial Y/\partial B) = 0,$$

$$(17)\quad P_x\, (\partial X/\partial B) + P_y\, (\partial Y/\partial B) = -\, X\, (\partial P_x/\partial B);$$

and incorporating this result in equation (16),

$$(\partial U/\partial B) = k\, \{P_x\, X\, (g_b/g)(\log X) - X\, (\partial P_x/\partial B)\},$$

$$(18)\quad (\partial U/\partial B)/k = \{P_x\, X\, (g_b/g)(\log X) - X\, (\partial P_x/\partial B)\},$$

and, as before, expressing equation (18) in terms of elasticities gives

$$(19)\quad (\partial U/\partial B)/k = \{(P_x X)/B\}\, \{(\log X)\, E_{g_b} - E_{p_x b}\},$$

where $E_{gb} = (\partial g/\partial B)(B/g)$ and $E_{p_x b} = (\partial P_x/\partial B)(B/P_x)$.

Note that this result completely parallels that derived for generic advertising developed in equation (12). While $(\partial U/\partial A)/k$ and $(\partial U/\partial B)/k$ parallel in their derivations, they differ in a number of essential ways. In particular, generic and brand advertising effects differ by g_a versus g_b, $(\partial P_x/\partial A)$ versus $(\partial P_x/\partial B)$ and the absolute levels of each type of advertising.

Implicit Prices for Generic and Brand Advertising

Equations (12) and (19) are interpreted as the marginal utility of an extra expenditure unit on generic and brand advertising, respectively. This interpretation is easily understood by examining the factors composing $(\partial U/\partial A)/k$ and $(\partial U/\partial B)k$. The total derivatives $(\partial U/\partial A)$ and $(\partial U/\partial B)$ show changes in the optimal levels of the consumer's utility when expenditures on generic and brand advertising vary with k being the marginal utility of money income. Thus, equations (12) and (19) are the changes in utility brought about by changes on expenditures of generic and brand advertising at the margin.

In this study, a similar but more useful interpretation for $(\partial U/\partial A)/k$ is to define it as the willingness to pay for generic advertising at the margin, or $(\partial U/\partial A)/k = S_a$, where S_a is the implicit price for generic advertising. Similarly, $(\partial U/\partial B)/k$ is also interpreted as the willingness to pay for brand advertising at the margin, or equivalently, the implicit price for brand advertising (S_b).

The implicit price for A (or B) can be either >0, $=0$, or <0. A positive implicit price indicates that the consumer is willing to pay a positive amount for an extra unit of generic (or brand) advertising at

the utility maximizing level (Nichols, 1985). The consumer's disposition to pay a positive implicit price for A (or B) also shows that the market (or producer) is undersupplying A (or B) from the consumer's perspective. A negative implicit price for generic (or brand) advertising indicates that the consumer is willing to pay a negative amount for an extra unit of A (or B). This negative willingness to pay shows that from the consumer's viewpoint the generic (or brand) advertising is oversupplied by the market. Finally, the third possibility of the implicit price for A (or B) to be equal to zero means that the consumer has a zero value in the willingness to pay for additional generic (or brand) advertising at the utility maximizing level. Thus, when S_a or $S_b = 0$, the amount of A (or B) provided by the market is optimal.

A number of different possibilities, such as S_a and $S_b > 0$; S_a and $S_b = 0$; S_a and $S_b < 0$; $S_a > 0$ and $S_b < 0$; or $S_a < 0$ and $S_b > 0$ can be shown graphically by obtaining the changes in the implicit price for A and B with increasing levels of generic and brand advertising (see Ward and Chang, 1985).

The actual value of the implicit price for generic (or brand) advertising depends on the expenditures on the advertised product (P_x X); the relative effect of generic (or brand) advertising on the advertising function, E_{ga} or E_{gb}, scaled by the level of product X used (log X); and the effect of A (or B) on the price of X, $E_{p_x a}$ or $E_{p_x b}$. These results parallel the ones developed by Nichols where he dealt with advertising in general. Furthermore, assuming P_x, X, and A (or B) are positive values, then the sign for the implicit price of generic

(or brand) advertising will depend on the following factors from equation (12) and (19):

$$((\log X)\, E_{ga} - E_{p_x a})$$

or

$$((\log X)\, E_{gb} - E_{p_x b}) .$$

In very general terms, the generic (or brand) advertising levels of a particular product are optimal, under, or oversupplied if the relative effect of advertising on the advertising function weighed by the product quantity ($(\log X) \cdot E_{ga}$ or $(\log X) \cdot E_{gb}$) is equal, greater, or less than the relative effect of advertising on the price of X, ($E_{p_x a}$) or ($E_{p_x b}$).

Intuitively, this interpretation implies that for the consumer to have optimal, under, or oversupplied levels of generic (or brand) advertising provided by the market, the information content (be it real or fancied) obtained by the consumer through the advertising function should be equal, greater, or less than the increase in price of X due to the advertising of the product at the margin.

At this point, a summary of the findings for the consumer's model of advertising is presented: the consumer is assumed to maximize the utility function subject to a budget constraint. The solution to this problem gives the levels of X and Y that maximize the consumer's utility given the levels of generic (A) and brand (B) advertising in the market. Further differentiation of the maximized utility function with respect to generic and brand advertising produces S_a and S_b, which are

the consumer's willingness to pay for generic and brand advertising at the margin, or the implicit prices for A and B, respectively.

The implicit price for generic (or brand) advertising includes those factors that theoretically affect the way the consumer values generic (or brand) advertising at the margin. Those factors are

1. The expenditures on the advertised product (P_x X).
2. The relative effect of generic (or brand) advertising on the advertising function; i.e., (E_{ga}) or (E_{gb}). This effect will basically depend on the particular attributes of the advertised product. Four possibilities arise: a) The particular attributes of the product are linked positively to generic advertising only. b) The attributes of the advertised product interact positively with brand advertising only. c) They have positive interaction with both types of advertising; i.e., the generic and brand advertising are complements. d) The product attributes have positive effects on generic (brand) advertising, but negative effects on brand (generic) advertising; i.e., generic and brand advertising compete against each other.
3. The effect of generic (or brand) advertising on the price of X, ($E_{p_x a}$) or ($E_{p_x b}$). This effect represents the structure of the market under which the advertised product is produced and consumed. Product differentiation, scale economies, barriers to entry, etc., are able to alter the demand and supply elasticities of the advertised good. The levels of these

elasticities will in turn influence the extent of the effect of A (or B) on the price of the advertised market product P_X.

4. The quantity of X consumed in the market (log X). The more X has been consumed, the more difficult for the advertisements to provide either real or fancied information to the consumer since he has already a good deal of experience in the consumption of X.

An Operational Advertising Model

The description of the implicit prices for generic and brand advertising in terms of elasticities is very useful for gaining an insight into what the implicit prices mean. For example, under this definition, the implicit price for generic (or brand) advertising is interpreted as some function of total expenditures on X, (P_X X); the relative effect of A (or B) on the advertising function g weighed by the log of X; the relative effect of A (or B) on P_X; and also on the level of A (or B). Furthermore, if P_X, X, and A (or B) are positive values, then for S_a (or S_b) to be equal to zero, the information content (either real or fancied) obtained by the consumer through the advertising function must be equal to the increase in price due to the advertising of the market product X.

This interpretation of the implicit prices in terms of elasticities does not readily provide a useful framework for studying all those components that are theoretically affecting the value of the implicit price for each type of advertising. That is, the particular attributes of the advertised product and factors affecting the market structure (and therefore the demand and supply elasticities) are not

immediately apparent with the elasticities expressions. Greater detail on the properties of E_{ga} (or E_{gb}) and $E_{p_x a}$ (or $E_{p_x b}$) is needed.

The implicit price for generic advertising was shown to be

$$S_a = (\partial U/\partial dA)/k = \{(P_x X)/A\}\{(\log X) E_{ga} - E_{p_x a}\}.$$

Writing out the elasticities terms,

$$S_a = \{(P_x X)/A\}\{(\log X)(\partial g/\partial A)(A/g) - (\partial P_x/\partial A)(A/P_x)\},$$

and eliminating the term A yields

$$(20) \quad S_a = (P_x X)\{(\log X)(\partial g/\partial A)(1/g) - (\partial P_x/\partial A)(1/P_x)\}.$$

In order to make S_a operational, both g_a and $(\partial P_x/\partial A)$ must be known. The implicit price for generic advertising can be simplified by obtaining an expression for X in terms of P_x and g. The direct generator of utility for the consumer is Z_i. The product X indirectly helps the consumer to maximize utility when it is combined with the advertising function g, assuming $Z_i = X^g$. The g function is actually activated by the levels of advertising. Thus, X can be looked on as a derived demand for the consumer's primary demand for the commodity Z_i.

To determine an expression for the derived demand for X, it is assumed that Z_i is a function of its shadow price, P_z,

$$(21) \quad Z_i = f(P_z),$$

where P_z is the shadow price for Z_i, and $(\partial Z_i/\partial P_z) < 0$. Also, other factors impacting Z_i are assumed fixed.

Noting that the first order condition of the consumer's utility maximizing problem with respect to X, yields (see equation (1)):

$$(\partial U/\partial X) = U_z\ g\ X^{(g-1)} - k\ P_x = 0,$$

$$U_z\ g\ X^{(g-1)} = k\ P_x,$$

or

$$(22)\quad (U_z/k) = (P_x\ X)/(g\ X^g).$$

And, as before, defining U_z/k as the shadow price of the commodity characteristic, Z_i:

$$(23)\quad (U_z/k) = (P_x\ X)(g\ X^g) = P_z.$$

Substituting this expression back into the implicit demand for Z_i (equation (21)) gives

$$(24)\quad Z_i = f(P_z) = f[(P_x\ X)/(g\ X^g)].$$

To derive an expression for the derived demand for X, the functional form for $Z_i = f(P_z)$ needs to be specified. For this study, the particular form $Z_i = \alpha_0\ (P_z)^{\alpha_1}$ was selected. This is a double logarithmic specification where α_1 represents the elasticity coefficient of Z_i with respect to P_z; i.e., the relative change in the commodity characteristic due to a percentage change in its price, P_z. The parameter α_0 captures all other factors impacting Z_i which are held fixed in this model. The slope of this functional form depends on α_1, as well as P_z. For example:

$$(\partial Z_i/\partial P_z) = \alpha_0\alpha_1 P_z^{(\alpha_1-1)},$$

or

$$(\partial Z_i/\partial P_z) = (Z_i/P_z)\ \alpha_1.$$

Furthermore, the overall shape of this function depends on the second derivative of Z_i with respect to P_z:

$$(\partial^2 Z_i/\partial P_z^2) = \alpha_0\alpha_1(\alpha_1-1)\ P_z^{(\alpha_1-2)},$$

or

$$(\partial^2 Z_i/\partial P_z^2) = (Z_i/P_z^2)(\alpha_1)(\alpha_1-1),$$

and the signs of these derivatives depend on the value of α_1. Even though α_1 is the most important coefficient for the function $Z_i=\alpha_0 P_z^{\alpha_1}$, when the expression for the demand for X is derived, it will be seen that there are other variables affecting the demand for X where α_1 is just one of several important parameters.

To continue the derivation of the demand for X, Z_i is substituted with X^g and P_z with $(P_x X)(g X^g)$ in equation (24),

$$(25)\quad X^g = \alpha_0[(P_x X)/(g X^g)]^{\alpha_1},$$

or

$$(26)\quad X^g = \alpha_0 P_x^{\alpha_1} g^{-\alpha_1} X^{(\alpha_1(1-g))}.$$

At this point the relationship is expressed in terms of observable variables in contrast to the non-observational set Z_i and P_z.

Solving for X:

$$X^{g} / X^{(\alpha_1(1-g))} = \alpha_0 P_x^{\alpha_1} g^{-\alpha_1},$$

$$X^{(g-\alpha_1+\alpha_1 g)} = \alpha_0 P_x^{\alpha_1} g^{-\alpha_1},$$

$$X = \alpha_0^{(1/v)} P_x^{(\alpha_1/v)} g^{-(\alpha_1/v)}, \tag{27}$$

where $v = g - \alpha_1 + \alpha_1 g$.

Equation (27) can be interpreted as the demand for the good X derived from the primary demand for the commodity Z_i. Note that advertising enters the demand for X through the g function. It is essential to know this function if the equations for the implicit prices of advertising are to be operational. That is, if the elasticities E_{ga}, E_{gb}, $E_{p_x a}$, and $E_{p_x b}$ are to be expressed in terms of meaningful parameters, the function g has to be developed; and the explicit parameters in the advertising function g and for equation (27) must be known. This will be completed in subsequent discussions. Substituting equation (27) back into S_a (equation (20)), yields the following form of the implicit price for generic advertising expressed in terms of observed data and parameters:

$$S_a = [\alpha_0^{(1/v)} P_x^{((\alpha_1/v)+1)} g^{-(\alpha_1/v)}] ([(\log(\alpha_0^{(1/v)} P_x^{(\alpha_1/v)} g^{-(\alpha_1/v)})) (\partial g/\partial A)(1/g)] - ((\partial P_x/\partial A)(1/P_x))). \tag{28}$$

A similar derivation for S_b parallels that derived for S_a,

$$(29)\quad S_b = [\alpha_0^{(1/v)} P_x^{((\alpha_1/v)+1)} g^{-(\alpha_1/v)}] \{[(\log(\alpha_0^{(1/v)} P_x^{(\alpha_1/v)} g^{-(\alpha_1/v)})) (\partial g/\partial B)(1/g)] - ((\partial P_x/\partial A)(1/P_x))\}.$$

The parameter α_0 is the constant coefficient in the demand for the commodity characteristic Z_i, and α_1 is the price elasticity of demand for Z_i. Note the fundamental role that advertising plays in the demand for X. Advertising (brand and generic) impacts the demand for X through shifts in demand via $\alpha_0^{(1/v)} g^{-(\alpha_1/v)}$ and through changes in the price elasticity via α_1/v (i.e., demand shifting and price responsiveness). The specific results, of course, depend on the specification of the Z_i function, but they do reflect the fundamental ways that advertising can change demand.

Of the remaining components on these implicit prices for advertising, g_a shows the effect of generic advertising on the advertising function, g. Similarly, g_b shows the impact of brand advertising on the advertising function. Also g_a and g_b are defined as the consumer's perception about the information (real or fancied) contained in the generic and brand advertisements, respectively. The parameter v is a power coefficient resulting from the derivation of the demand for X, and is a function of α_1 and g. The advertising function g will be defined later and all factors depending on this function (e.g., g_a and g_b) will also be defined at that point.

The final elements to be explained in S_a and S_b are $(\partial P_x/\partial A)$ and $(\partial P_x/\partial B)$. These two partials explain the impact of A and B on the price

of the product being advertised. At this point, the producer is introduced into the model. The market price of X is impacted by the producer when trying to maximize profits through both types of advertising.

The Producer and Advertising

Among the important questions asked by a producer before the actual production of a product takes place are

1. What levels of the product should be produced?

2. What levels of brand advertising should be used?

3. Will generic advertising be used and, if so, at what level?

These questions can be addressed if it is assumed producers have specific goals in mind. The relative change of P_X when A (or B) are changed will depend on the particular goal chosen by the producer.

As stated earlier, it will be assumed that the producer's goal is to maximize profit, and the commodity characteristic is produced under perfect competitive conditions. Under these assumptions, Z_1 can be indirectly supplied by many producers even though few actual producers supply the same market product, X. Therefore, a producer could (indirectly) supply an unlimited quantity of the commodity characteristic at a fixed price. If the level of advertising is given, P_Z would have one to one correspondence with P_X (see equation (1)). However, if the level of advertising is also a variable, the producer could sell X at different prices by varying the level of advertising. This occurs because an increase in advertising would increase the output of the commodity characteristic that the consumer receive from a given

amount of the market product, therefore increasing P_x relative to the fixed competitive price for P_z.

In mathematical terms,

$$\pi = P_x X_j - TC(X_j) - P_a A - P_b B,$$

where π is profit; $TC(X_j)$ is the total cost of producing X, excluding the costs for generic and brand advertising; X_j is the quantity of X supplied by an average maximizing producer; P_a is the price of A; and P_b is the price of B.

The first order conditions for this optimizing problem are

$$(\partial\pi/\partial X_j) = P_x - MC(X_j) = 0;$$

$$(\partial\pi/\partial A) = (\partial P_x/\partial A) X_j - P_a = 0; \text{ and}$$

$$(\partial\pi/\partial B) = (\partial P_x/\partial B)X_j - P_b = 0.$$

These conditions yield

$$(30) \quad P_x = MC(X_j).$$

$$(31) \quad (\partial P_x/\partial A) X_j = P_a.$$

$$(32) \quad (\partial P_x/\partial B)X_j = P_b.$$

Equation (30) states that, under the assumption of π maximizing, the optimal amount of X_j to produce is where the price of the product equals its marginal cost. Equation (31) states that a profit maximizing producer will utilize generic advertising to the level where the effect induced in P_x from the use of the generic advertising,

weighed by the amount of X produced, equals the added cost of a unit of advertising. In other terms, the optimal level of generic advertising for a profit maximizing producer is where the marginal revenue product of generic advertising equals its marginal cost. Similarly, for equation (32), a profit maximizing producer will equate the marginal revenue product of brand advertising to its marginal cost.

To make this model of producer and advertising operational, it is necessary to specify the form of the total cost function. This function is specified as

$$(33) \quad TC(X_j) = \beta_0 X_j^{\beta_1},$$

where $\beta_0 > 0$ and $\beta_1 > 1$.

This functional form was chosen because it can be representative of a wide array of cost relationships. The parameter β_0 captures all other factors which are held fixed in the cost function. It has a slope that depends on the value of β_1,

$$(\partial TC/\partial X_j) = MC(X_j) = \beta_0\beta_1 X_j^{(\beta_1-1)}$$

or

$$(34) \quad MC(X_j) = (TC/X_j)\,\beta_1,$$

and the value of the second derivative determines the overall shape of this function,

$$((\partial TC/X_j)\beta_1)/(\partial X_j)) = (\partial(\beta_0\beta_1 X_j^{(\beta_1-1)})/(\partial X_j)),$$

$$(\partial MC)/(\partial X_j) = \beta_0\beta_1(\beta_1-1)\ X_j^{(\beta_1-2)},$$

$$(\partial MC)/(\partial X_j) = (TC/X_j^2)(\beta_1)\ (\beta_1-1).$$

If $0<\beta_1<1$, the total cost function increases at a decreasing rate. If $\beta_1>1$, the total cost function increases at an increasing rate. It is more likely to have $\beta_1>1$; i.e., the cost function is in the stage of production characterized by an increasing cost per unit as more output is produced. This functional form is illustrated in Figure 3.2.

Using the result from equation (30),

$$P_x = MC,$$

then,

$$(35)\quad P_x = \beta_0\beta_1\ X_j^{(\beta_1-1)}.$$

But, it is known from the demand for X (equation (27)), that

$$X = \alpha_0^{(1/v)}\ P_x^{(\alpha_1/v)}\ g^{-(\alpha_1/v)},$$

$$P_x^{(\alpha_1/v)} = X\ \alpha_0^{-(1/v)}\ g^{(\alpha_1/v)},$$

or

$$(36)\quad P_x = X^{(v/\alpha_1)}\ \alpha_0^{-(1/\alpha_1)}\ g.$$

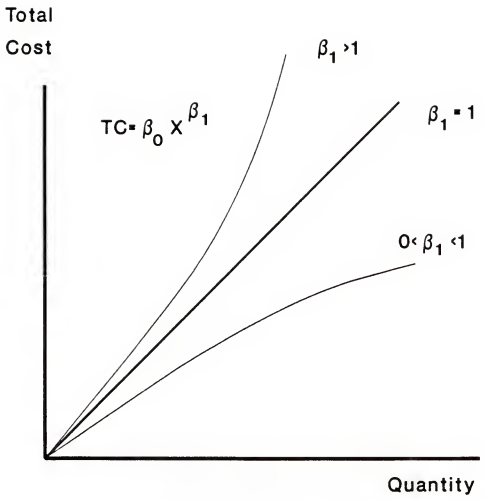

Figure 3.2 A General Double-Log Cost Function

The substitution of equation (36) back into equation (35) yields

$$(37) \quad X^{(v/\alpha_1)} \alpha_0^{-(1/\alpha_1)} g = \beta_0 \beta_1 X_j^{(\beta_1 - 1)}.$$

At this point it is necessary to explain the difference between X, the quantity of product demanded by an individual consumer, and X_j, the amount supplied by an individual producer, and how this difference is accounted for and reconciled in the advertising model.

Theoretically, P_X is obtained by equating total quantity supply (X^S) to total quantity demand (X^D) in the market. If it is assumed that X is the optimal level demanded by an utility maximizing average consumer, X_j as the optimal level produced by a profit maximizer average producer, m as the total number of consumers of the product X, and n as the total number of producers of X, then the relationship $X^S = X^D$ can be redefined as

$$nX_j = mX$$

or

$$(38) \quad X = (n/m)X_j;$$

i.e., the optimal quantity demanded by an average consumer (X) is a proportion of the optimal quantity supplied by an average producer (X_j), where the proportion is given by the ratio of the total number of producers over the total number of consumers.

Substituting equation (38) back into equation (37) gives

$$((n/m)X_j)^{(v/\alpha_1)} \alpha_0^{-(1/\alpha_1)} g = \beta_0 \beta_1 X_j^{(\beta_1 - 1)},$$

and solving for X_j yields

$$\frac{((n/m)\, X_j)^{(v/\alpha_1)}}{X_j^{(\beta_1-1)}} = \beta_0\, \beta_1\, \alpha_0^{(1/\alpha_1)}\, g^{-1},$$

$$(n/m)^{(v/\alpha_1)}\, X_j^{((v/\alpha_1)-(\beta_1-1))} = \beta_0\, \beta_1\, \alpha_0^{(1/\alpha_1)}\, g^{-1},$$

$$X_j^{(v-\alpha_1\beta_1+\alpha_1)/\alpha_1} = \beta_0\, \beta_1\, \alpha_0^{(1/\alpha_1)}\, g^{-1}\, (n/m)^{-(v/\alpha_1)},$$

$$(39)\quad X_j = (\beta_0\beta_1)^{\alpha_1/(v-\alpha_1\beta_1+\alpha_1)}\, \alpha_0^{1/(v-\alpha_1\beta_1+\alpha_1)}\, g^{-\alpha_1/(v-\alpha_1\beta_1+\alpha_1)}\, (n/m)^{-(v/(v-\alpha_1\beta_1+\alpha_1))}.$$

Since $v = (g-\alpha_1+\alpha_1 g)$, and also assuming n and m are large numbers whose ratio is approximately one; i.e., $(n/m)=1$, then

$$(40)\quad X_j = (\beta_0\beta_1)^{(\alpha_1/c)}\, \alpha_0^{(1/c)}\, g^{-(\alpha_1/c)},$$

where $c = g + \alpha_1 g - \alpha_1\beta_1$.

Equation (40) represents the quantity of X supplied by the producer when both supply and demand factors are included. This expression for X_j is substituted back into equation (31), the marginal condition for the producer, yielding

$$(\partial P_x/\partial A)\, X_j = P_a,$$

$$(\partial P_x/\partial A) = (X_j^{-1})\ (P_a),$$

$$(41)\quad (\partial P_x/\partial A) = (\beta_0\beta_1)^{-(\alpha_1/c)}\ \alpha_0^{-(1/c)}\ g^{(\alpha_1/c)}\ P_a.$$

And, similarly substituting equation (40) back into equation (32) yields

$$(\partial P_x/\partial B)\ X_j = P_b,$$

$$(\partial P_x/\partial B) = (X_j^{-1})\ (P_b),$$

$$(42)\quad (\partial P_x/\partial B) = (\beta_0\beta_1)^{-(\alpha_1/c)}\ \alpha_0^{-(1/c)}\ g^{(\alpha_1/c)}\ P_b.$$

A Revised Expression for X

As stated previously, X derived through the commodity characteristic Z_i includes only the demand factors. This formulation is quite useful to illustrate two basic effects of advertising on X; i.e., the demand shifting and the price responsive effect (see equation (27)). Yet, X is not only affected by the demand factors, but also through the supply factors, since, essentially, total quantity supply (X^S) equates total quantity demand (X^D) in the market. This revised expression for X, including both supply and demand factors, will be incorporated into the advertising model.

Consumer, Producer and Advertising

The stage is set to obtain an integrated model of advertising, where the behavior of the two economic agents, the producer and the

consumer, are included. Substituting ($\partial P_x/\partial A$) and ($\partial P_x/\partial B$), equations (41) and (42), respectively, and the revised expression for X back into equations (28) and (29) yield

$$(43)\quad S_a = [\, P_x\, (\beta_0\beta_1)^{(\alpha_1/c)}\, \alpha_0^{(1/c)}\, g^{-(\alpha_1/c)} \,]$$

$$\{\, [\log\, ((\beta_0\beta_1)^{(\alpha_1/c)}\, \alpha_0^{(1/c)}\, g^{-(\alpha_1/c)})]$$

$$[(\partial g/\partial A)(1/g)] - [\, ((\beta_0\beta_1)^{-(\alpha_1/c)}\, \alpha_0^{-(1/c)}$$

$$g^{(\alpha_1/c)}\, P_a)\, (1/P_x)\,]\,\},$$

and

$$(44)\quad S_b = [\, P_x\, (\beta_0\beta_1)^{(\alpha_1/c)}\, \alpha_0^{(1/c)}\, g^{-(\alpha_1/c)} \,]$$

$$\{\, [\log\, ((\beta_0\beta_1)^{(\alpha_1/c)}\, \alpha_0^{(1/c)}\, g^{-(\alpha_1/c)})]$$

$$[(\partial g/\partial B)(1/g)] - [\, ((\beta_0\beta_1)^{-(\alpha_1/c)}\, \alpha_0^{-(1/c)}$$

$$g^{(\alpha_1/c)}\, P_b)\, (1/P_x)\,]\,\}.$$

In these two expressions for the implicit prices of generic and brand advertising, the only factors yet to be defined are the

advertising function, g; the marginal productivity of generic advertising, g_a; and the marginal productivity of brand advertising, g_b.

The Advertising Function

The advertising function, g, should basically include the element of generic advertising, A, the element of brand advertising, B, and the direct interaction (complementary or competing) between generic and brand advertising. The reason for including these three elements in the advertising function is that the perception of the information conveyed by the advertisements depends on the type of advertising utilized and the cross-effect (either positive or negative) between the types of advertising utilized in the market. At the same time, the relative effect of the g function depends on the particular attributes of the advertised product. Some attributes of the market products might have a positive relationship with generic advertising, other characteristics will be related positively to brand advertising, and still others might render the use of advertising (either generic or brand) unprofitable.

The particular functional form representing the advertising function g should also have the following properties: First, the function should include the possibility of obtaining a positive level of g even when there is no advertising. The omission of this property will allow the case where g=0. When g is allowed to be zero, the commodity characteristic Z_i, will be equal to one; that is, $Z_i = X^g = X^0 = 1$. It says that no matter how much X is utilized to produce Z_i, the commodity characteristic will always be a constant equal to one. There is no intuitive economic meaning to this particular case, and

therefore it needs to be eliminated. It is eliminated by selecting a specific function which gives a positive g in the case of zero advertising (either generic or brand). Also this simply implies that some levels of Z_i for given X are realized even though no formal advertising takes place. For some commodities where considerable information is already known, this may be typical. Thus the inclusion of this property allows the production of Z_i to vary with different levels of X, and it also reflects the fact that the consumer has some basic knowledge of the product. This basic knowledge could have been acquired through previous consumption of the product or previous advertising of the product in the market. Therefore, this property is particularly useful in the analysis of the effects of advertising on agricultural products, since most of them are being consumed (thus, experienced) for many years.

Second, the function to be chosen must approach an upper limit. This upper limit is justified when one observes that advertising can not always increase the level of information conveyed to the consumer through the advertisements. For example, it can be expected that, after continuously advertising a particular product, a level of advertising is reached where more knowledge about the product cannot be provided. Once g is at its upper limit, the marginal productivity of generic (or brand) advertising is equal to zero.

Third, the particular functional form selected to represent the advertising function must be expected to increase at an increasing rate at lower levels of advertising, and to increase at a decreasing rate at higher levels until it reaches its upper limit. Advertising can

provide large amounts of information content to the consumers through the initial levels of advertising (either generic or brand) expenditures. As the levels of advertising become larger, it can be expected that the advertising's potential for conveying information decreases because the informational set has also been reduced.

For this study, a logistic function was selected to represent g. The logistic function encompasses those important theoretical characteristics that an advertising function should possess. This function has the following form (Kotler, 1971):

$$Q = \frac{Q_0}{1 + e^{(a+bR)}},$$

where Q_0 is the highest value the function can take (its upper limit); e is the base of the natural logarithmic system; a is a constant; b is the rate of growth of the function in response to R; and R can be any marketing instrument.

This function produces an S-shaped curve with an intercept equal to $Q_0/(1+e^a)$ and a higher asymptote equal to Q_0. A logistic function is illustrated in Figure 3.3.

The logistic form representing the advertising function is defined as

$$(45) \quad g = \frac{g_0}{1 + e^{(\delta_0 + \delta_1 A^{\theta_1} + \delta_2 B^{\theta_2} + \delta_3 (A)(B))}},$$

where g_0 is the upper asymptote, A represents the expenditures on generic advertising, B represents the expenditures on brand

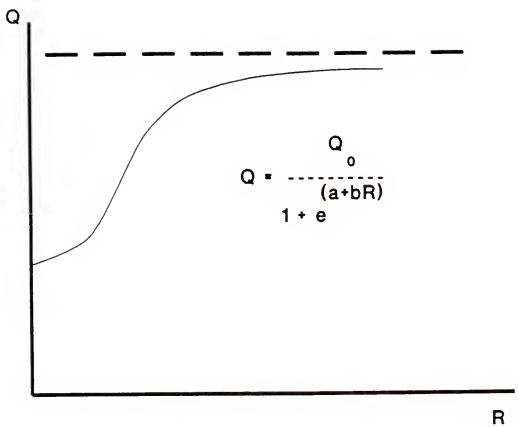

Figure 3.3 A General Logistic Function

advertising, δ_0 is the current level of product knowledge, δ_1 is the generic advertising parameter, δ_2 is the brand advertising parameter, δ_3 is the direct interaction between A and B, and θ_1 and θ_2 are two parameters used for both model consistency and convenience since this type of specification will assure having values of A and B in the solution of the advertising model.

If A and B are assumed to be zero, then the intercept is $g_0/(1+e^{\delta_0})$. The upper asymptote for this functional form is g_0, and it represents the upper limit of the function g, or, similarly, the maximum value of information that advertising can transfer through the advertisements to the consumers.

The parameter δ_3 represents the direct interaction between generic and brand advertising, and reflects, partly, the quality of information conveyed in the advertisements. This parameter can be positive, negative, or zero. Its value depends on the type of information (fancied or factual) delivered to the consumer and the ease of validating that factual or fancied information.

Marginal Productivities of Generic and Brand Advertising

To complete the model specification, the marginal productivities of generic and brand advertising, g_a and g_b, must be derived. These two marginal productivities for generic and brand advertising can be derived directly from the advertising function, g. If g is transformed to logarithms, the differentiation with respect to A and B is simplified,

$$g = g_0 \,/\, (1 + e^{(\delta_0 + \delta_1 A^{\theta_1} + \delta_2 B^{\theta_2} + \delta_3(A)(B))}),$$

$$((g_0/g) - 1) = e^{(\delta_0 + \delta_1 A^{\theta_1} + \delta_2 B^{\theta_2} + \delta_3(A)(B))} ,$$

$$\log((g_0/g)-1) = (\delta_0 + \delta_1 A^{\theta_1} + \delta_2 B^{\theta_2} + \delta_3(A)(B)). \quad (46)$$

Differentiating equation (46) with respect to A gives

$$\{ [1/((g_0/g)-1)] (-g_0/g^2) g_a \} = \theta_1 \delta_1 A^{(\theta_1-1)} + \delta_3 B ,$$

$$-[(g/(g_0-g))(g_0/g^2)g_a] = \theta_1 \delta_1 A^{(\theta_1-1)} + \delta_3 B ,$$

$$-[(g_a g_0)/(g(g_0-g))] = \theta_1 \delta_1 A^{(\theta_1-1)} + \delta_3 B ,$$

$$g_a = -\{ g (g_0-g) (\theta_1 \delta_1 A^{(\theta_1-1)} + \delta_3 B) \}/g_0 . \quad (47)$$

Similarly for g_b, differentiating equation (46) with respect to B yields

$$\{ [1/((g_0/g)-1)](-g_0/g^2) g_b \} = \theta_2 \delta_2 B^{(\theta_2-1)} + \delta_3 A ,$$

$$-[(g/(g_0-g))(g_0/g^2) g_b] = \theta_2 \delta_2 B^{(\theta_2-1)} + \delta_3 A ,$$

$$- [(g_b g_0)/(g(g_0-g))] = \theta_2 \delta_2 B^{(\theta_2-1)} + \delta_3 A ,$$

$$g_b = - \{g (g_0-g) (\theta_2 \delta_2 B^{(\theta_2-1)} + \delta_3 A)\} /g_0 . \quad (48)$$

The Final Advertising Model

Finally, substituting equations (45), (47) and (48) back into equations (43) and (44), gives the following specification for the consumer's advertising model:

$$(49)\quad S_a = [P_x((\beta_0\beta_1)^{(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))} \alpha_0^{(1/(g+\alpha_1 g-\alpha_1\beta_1))} g^{-(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))})] \{ [(\log((\beta_0\beta_1)^{(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))} \alpha_0^{(1/(g+\alpha_1 g-\alpha_1\beta_1))} g^{-(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))}))(-(g_0-g)(\theta_1\delta_1 A^{(\theta_1-1)} + \delta_3 B)/g_0)] - [(1/P_x)((\beta_0\beta_1)^{-(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))} \alpha_0^{-(1/(g+\alpha_1 g-\alpha_1\beta_1))} g^{(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))} P_a)] \},$$

and

$$(50)\quad S_b = [P_x((\beta_0\beta_1)^{(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))} \alpha_0^{(1/(g+\alpha_1 g-\alpha_1\beta_1))} g^{-(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))})] \{[(\log((\beta_0\beta_1)^{(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))}$$

$$\alpha_0^{(1/(g+\alpha_1 g-\alpha_1\beta_1))}\, g^{-(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))})$$

$$(-(g_0-g)(\theta_2\,\delta_2\,B^{(\theta_2-1)} + \delta_3 A)/g_0)] - [(1/P_x)$$

$$((\beta_0\beta_1)^{-(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))}\, \alpha_0^{-(1/(g+\alpha_1 g-\alpha_1\beta_1))}$$

$$g^{(\alpha_1/(g+\alpha_1 g-\alpha_1\beta_1))}\, P_b)]).$$

CHAPTER IV

PRODUCT ATTRIBUTES AND STRUCTURAL FACTORS

Introduction

In the previous chapter, a comprehensive and detailed model for generic and brand advertising was constructed. This model included the two physical-economic agents, the producer and the consumer, who are known to play the role of supplier and receiver of advertising, respectively. It also included the main factors that theoretically define the degree and intensity (reactions) of the consumer's behavior towards each type of promotion utilized in the market. These factors were classified into two distinctive groups whose combined effects determine the efficiency of each type of advertising and therefore the optimal levels of advertising for a particular product in the market.

The attributes of a product encompass one set of factors that determine the degree of perception (g_a and g_b) and therefore the quantity of the perceived commodity characteristic (Z_i) that an average consumer acquires from the advertisements (A or B) of a market product (X). A second set of factors that regulate the adjustments of the product price (P_x) due to changes in the use of generic and brand advertising are those elements defining the market structure of the product. In this advertising model, the effects of all the structural factors on the price of the advertised product are combined and

summarized in the price elasticity of supply (e_s) and the price elasticity of demand (e_d).

Product Attributes and The Advertising Function

In general, it is assumed that the levels of the parameters for generic and brand advertising (δ_1 and δ_2) in the advertising function (which define the effectiveness of advertising) depend on the ability of a particular product attribute to differentiate the product in the market. The evaluation of the product attributes in achieving product differentiation will be essential to separate the potential effects of generic and brand advertising. The advertising function itself will also be affected by the assumed consumer's current knowledge (δ_0) of the advertised product.

The main attributes of a product theoretically related to advertising are the identification of the product, the nutritional characteristics of the good, the homogeneity of the product, the set of grades and standards utilized to classify each product, the number and types of uses that a product can take, and packaging of a product (which might include other product services).

Each product attribute should have a specific impact on the levels of the parameters for generic advertising, δ_1; for brand advertising, δ_2; and for the direct interaction between generic and brand advertising, δ_3.

Identification

The identification of the product refers to how easily a consumer recognizes the product being advertised. Products marketed and sold fresh or unprocessed can normally be recognized more easily than

products marketed in a processed form. This is because most processed products are combinations of several ingredients, where the physical characteristics (color, texture, etc) and sensations (such as smell) of any particular ingredient (product) are either hidden or difficult to recognize.

Even though a processed product is usually more difficult to identify than an unprocessed one, the level of identifiability will vary among different goods due to the degree of combination of the ingredients associated with the processing. For example, when eggs are marketed as ingredients of cakes and waffles, they are not recognized as eggs. Meat (most types) is not so difficult to identify, even in processed forms, such as sausages, ready to eat meat dinners, and luncheon meats. Flowers (most kinds) are very easy to recognize either as fresh cut flowers or as parts of a floral arrangement (processed product).

Nutritional Characteristics

These characteristics are the most basic product attribute that seems to have an impact in the mind of the consumer through the use of advertising. Nutritional attributes can be defined as the nutritive level provided by a product to the human diet. Of special importance is a set of four groups of nutrients known as the essential chemicals of any food diet: the amino acids, which are the chemical elements forming the proteins; the major minerals, which are salts needed in relatively large quantity for life sustainability; the trace minerals, which are needed in relatively tiny amounts in any person's diet; and the vitamins essential for growth and maintenance of body cells and organs.

Agricultural products have a whole range of goods that vary in their nutritional content, and the level of success in promoting these products can be partly attributed to the consumer's perception of the nutritive value of a particular product.

Homogeneity

A homogeneous product is one that basically cannot be differentiated. This homogeneity refers to having all units of a product exactly equal in texture (the way they feel when touched) and structure (form, size, etc.) inside and out. It also refers to physical attributes, such as the color of the product.

The degree of homogeneity will vary among agricultural products. For example, it can be assumed that the product salt is relatively more homogeneous than the product apple, and the apple is relatively more homogeneous than the product flower; therefore, the product salt is relatively more homogeneous than the product flower.

Grades and Standards

Grades and standards can be defined as methods of classifying units of a product such that the variation or range in quality is smaller within the group than over the whole range of the product. This is also a very important attribute for evaluating the effects of both generic and brand advertising. It shows some measure of the homogeneity of the product across grades and within grades in the case of generic advertising. Also, it provides a way to differentiate a brand product due to real differences.

Number and Type of Uses

Type of uses of a product refers to a product being utilized either fresh or processed and transformed into a different product. Number of uses of a product refers to the different uses that a good can be put to once it is within the fresh and processed forms. This product attribute is important when evaluating advertising because it defines the different groups of consumers that can be targeted in the advertising campaign. For example, an advertisement is likely to reach many more consumers when a product has many uses than when it has only a few (the verification of this statement, of course, will also depend on the advertising media to be utilized).

This product attribute is also important for the study of advertising because it relates to the identity of the advertised product. As stated earlier when covering the attribute identification of the product, a product used in a processed form is relatively more difficult to identify than in its unprocessed form because in the former case the product is more likely to lose its physical identity compared to the latter.

Packaging

This is not a true product attribute, but it seems to be closely connected to the other product attributes determining the level of the brand advertising parameter. The main purpose of packaging is to help produce a differentiated brand product by using an attractive package.

Group Determinants of the Advertising Function

It is possible to classify the attributes of the products into two categories, where one group includes those attributes strongly related

to generic advertising and the second group those attributes strongly related to brand advertising. The main reason for this classification is that each and every one of the product attributes has a definite impact on the level of each particular type of advertising, and at the same time, there is not a single product attribute which by itself can determine the level of either the generic or the brand advertising parameter in the advertising function. In other words, the level of either advertising parameter is more likely to be determined by a combined effect of several product attributes. Another important reason for classifying the attributes is that it might facilitate the evaluation of the levels for the advertising parameters for two distinct agricultural products. It should be also emphasized that a single product attribute when combined with others might help determine either or both levels of the parameters of the advertising function; i.e., some attributes can be strongly related to both generic and brand promotions.

Major Determinants of δ_1

The major product attributes determining the level of the generic advertising parameter are the nutritional characteristics of the product, the product identification, the number and type of product uses, the homogeneity of the product, and the set of grades and standards.

The nutritional characteristics of a product should be the single most dominant factor having a major impact on the level of δ_1. The parameter for generic advertising, δ_1, can be assumed to be positively related to the health characteristics attribute. The higher the

positive health characteristics, the higher the level of δ_1 that should be expected. Also, the level of δ_1 should decrease as the consumer learns more about the product through advertising, because, once the consumers know about the basic health characteristics, the more difficult it is for the advertisements to convince the buyer to consume more of the product. Still, generic advertising is expected to have a positive effect as a reminder of the nutritive quality of the product. This product attribute is perhaps the only one that by itself will be important in determining the level of the generic advertising parameter.

The identifiability of the product should also be a determinant of the level of δ_1. A highly identifiable product (one that keeps its identity throughout the marketing chain) will be easier to advertise generically. The identification of a product is expected to be positively related to the generic advertising parameter, δ_1. Still, its actual positive relationship with δ_1 will depend on the presence of other product attributes that are also expected to have a positive relationship with this generic advertising parameter, such as the health characteristics of the product. An easily identifiable, healthful product should have a larger generic advertising parameter than a less easily identifiable equally healthful product. If advertisers want to succeed in their efforts of jointly (generically) promote a product, the identity of the product should be readily recognizable; otherwise the consumers have nothing in sight that allows them to relate to the generically advertised product.

A third important factor determining the level of the advertising generic parameter is the number and type of uses of a product. In a

sense, this attribute is similar and relates to product identification. A product can be marketed fresh (or unprocessed) or as a processed product. This classification is very basic and simple but one that will allow a general comparison of two distinct products. A more complex classification, such as by product function, will be difficult to manage at this stage. The more identifiable the product is within the number and type of uses, the larger the generic parameter, because generic advertising can reach a larger audience (it is assumed more uses will attract more people) who can readily recognize the product within the different product uses.

Another important factor affecting the level of δ_1 is the homogeneity of the product. However, it is easier for the consumer to relate to generic advertisements of products with other attributes than just to homogeneous products. Thus, δ_1 might not be related to a solely homogeneous product. This attribute of homogeneity of a product is expected to be positively linked to δ_1. A joint advertising effort on a nutritive homogeneous product should be more successful than the same effort on a heterogeneous one because there is less room for product differentiation and therefore the producers have no incentive to use brand advertising.

Generic advertising should have a positive relationship with respect to a well-organized set of grades and standards for a product. This is because the product can be easily recognized in each category of grades and standards. Under each grade or standard the product can be seen as quite homogeneous. This implies that the product attribute of homogeneity mentioned above, might also be treated as a subset of the

product attribute of grades and standards when the product is evaluated within a particular category. As with homogeneity, this attribute is expected to have a positive interaction with generic advertising when it is found in combination with, for example, a nutritive product.

Even though the health characteristics, the identifiability of a product, the number and type of uses, homogeneity of a product, and grades and standards are important in determining the level of δ_1, their relative importance varies among goods. The two most important factors are the nutritional characteristics of the product and the product identifiability, followed by the number and type of uses, the homogeneity of the product and the product grades and standards. This analysis implies that, to succeed with generic advertising efforts, the minimum requirement is the presence of a readily identifiable product with a positive set of health characteristics. It might not be efficient to generically advertise a product that is highly identifiable and also has a highly identifiable number and types of uses, when at the same time the product is not perceived as a contributor to a nutritious consumer diet.

For example, compare the products milk and eggs. Milk is easily recognized in its processed liquid forms, yet not so easily recognized as butter, yogurt, cheese, etc. It is a highly nutritive product because it is a source of protein, vitamins and minerals. On the other hand, eggs are also easily recognized when they are marketed as fresh eggs, but hardly recognizable when they are mixed in cakes and waffles. Eggs are a good source of protein, major minerals and vitamins, but they are also a source of a relatively high level of cholesterol, which is

associated with health problems. Thus, milk might be expected to have a relatively higher response to generic advertising than eggs; i.e., $|\delta_1|$-milk > $|\delta_1|$-eggs.

Major Determinants of δ_2

The major product attributes determining the level of the brand advertising parameter, δ_2, are the identifiability of the product, number and type of uses of a product, the homogeneity of the product, the set of grades and standards available for the product, and packaging and other services.

Note that the consumer's level of knowledge of the product attributes is the only factor not included in the discussions of the major determinants for either δ_1 or δ_2. This factor determines the level of δ_0, which is the major determinant of the initial current level of product information (the intercept) in the advertising function and will be described in subsequent discussions.

The most important product attributes determining the level of the brand advertising parameter, δ_2, are the identifiability of the product and the number and type of product uses. In the case of δ_2, it will be assumed that for successful use of brand advertising, the product (or its use) to be advertised can be identified. An unidentified product or use of a product will be difficult to advertise because the consumer will not be able to recognize the brand product. Thus, these two product attributes are positively related to δ_2. Still, they alone cannot determine the level of δ_2. There is not much logic in using brand advertising for a product only because it can be identified. The

presence of at least one other product attribute, such as product heterogeneity, is necessary.

Another major product attribute determining the level of δ_2 is the homogeneity of the product. One of the main goals of brand advertising is to use promotion to differentiate a brand in the market. The producer of a brand has less incentive to advertise if the product is basically homogeneous, not differentiable. Thus, the lower the degree of homogeneity of the product, the higher the level of δ_2 that should be expected.

A homogeneous product should render brand advertisements useless. It is difficult to find a reasonable justification for having brand advertisements when the product cannot be differentiated at all. A clear example is the product salt. There is hardly any brand advertising for this product.

Another important factor determining the level of δ_2 is the set of grades and standards available for the product. Both the presence and the absence of a well established set of grades and standards for a particular product can generate a positive relationship between the attribute grades and standards and the parameter δ_2. The lack of a good set of standards for a product provides an opportunity for the brand advertiser to convince the consumer through fancied advertisements. On the other hand, the presence of a well-defined set of grades and standards for a product can also be used by the producer to differentiate the product through using advertisements with real (factual) claims. Therefore, a well-established set of grades and standards will have a strong positive relationship to a brand with real

differentiable attributes. This is because the consumer can relate a specific grade or standard with a particular brand. Still, it is also possible that a well-established set of grades and standards will have a weak positive relationship with brand advertising when the product within the grades is basically homogeneous and there exists fancied advertising on the brand.

Packaging is another important factor determining the level of δ_2. A product brand with a well-designed package can outsell other brands. The use of attractive packaging can help not only in identifying the brand product but also in providing a view of product quality (real differences). It might also be the case that the packaging itself is so well designed for a particular brand, that irrespective of any other product quality characteristics (i.e., freshness, texture, color, etc.), the attractive packaging helps to sell the advertised brand by attracting old and new customers alike. Another aspect of packaging is to achieve reinforcement of the product in the consumer's mind (Sheth, 1974). The advertising mechanism of reinforcement continually directs the consumer's attention to a particular brand in order to achieve brand loyalty. For example, all brands of orange juice (either fresh or frozen concentrated) have a very distinctive package (particularly the colors used) that makes them readily differentiated on the refrigerated or freezer shelves at the retail stores. Another example is provided by comparing salt and flowers. Salt is a highly homogeneous product, where the packaging for different brands might not make any difference, if advertised. This might be the reason why different brands of salt are advertised very little or not at all. Flowers, on the other hand,

are highly differentiable commodities that do not have a clear set of grades and standards, and can attract many customers through packaging. Thus, brand advertising should be relatively more successful when used for flowers than for salt; i.e., $|\delta_2|(\text{flower}) > |\delta_2|(\text{salt})$.

Product Attributes and δ_3

The direct interaction between generic and brand advertising is given by the advertising parameter δ_3. This parameter can be positive, negative, or zero, depending on the levels of δ_1 and δ_2, which in turn are determined by the presence or absence of certain product attributes. This parameter δ_3 also partially reflects the quality of information conveyed in the advertisements. The quality of information should be evaluated under two related conditions. The first condition is to evaluate the advertisements of a product for fancied or real information. The second condition refers to the ease of validating the advertisement claims about a product.

The direct interaction of A and B can be expected to be positive when the advertised product possesses respected, healthful characteristics and at the same time is also fairly differentiable (heterogeneous). Take, for example, flowers, which have decorative appeal and are also differentiable. The parameter δ_3, in this case, will be assumed positive; i.e., generic and brand advertising are complements for this product. Another example of positive δ_3 is the case of any recently initiated advertising program for an agricultural product. It is more likely to have a complementary relationship between generic and brand advertising early in the promotion of the agricultural

product when both types of advertising can provide real information about the product to the consumer.

The direct relationship between A and B can be expected to be negative when the product to be advertised has good healthful attributes and at the same time it is quite homogeneous. It is assumed in this particular case that the brand advertisements (claiming the homogeneous product to be differentiable) have no effect on the consumer's perception of the product, since the product is perceived as homogeneous by the consumer, and because there is a partial offsetting effect through the generic advertisements. Milk, for example, has very good nutritive properties (such as protein, calcium, and vitamin D), but it is also basically a homogeneous product. Thus, it is expected that generic advertising will increase the demand for milk and counterbalance, to some extent, the effect of any brand advertisements of milk in the market. A negative parameter δ_3 reinforces the competing interaction between generic and brand advertising.

Finally, the advertising parameter δ_3 can take the value of zero. This situation might occur when the product to be advertised has no major health attributes and is also highly homogeneous. In this case the direct relationship between generic and brand advertising is null (or quite small). Take the product salt as an example. Salt has no major real or perceived health attributes and is a highly homogeneous product. Thus, it is expected that generic and brand advertising might not be related through δ_3.

In practice, δ_3 is difficult to evaluate. Nonetheless, one can assume $\delta_3=0$ when doing the simulations with the advertising model,

without much loss in the overall theoretical model. Generic and brand advertising for a product are still related through the parameters δ_1, δ_2, and the levels of A and B currently being used in the market. That is, even when δ_3=0, B still influences A and A influences B,

$$g_{ab} = -\, g_0\{\, g(g_0-g)\delta_3 + (\theta_1\, \delta_1\, A^{(\theta_1-1)} + \delta_3 B)(g_0-2g)g_b\,\}$$

letting δ_3=0 and g_0=1,

$$g_{ab} = -\{\, (1-2g)(\theta_1\, \delta_1\, A^{(\theta_1-1)})(g_b)\,\} \leq 0.$$

Furthermore, under the assumption of δ_3=0, the optimal amounts of generic and brand advertising in the model are obtained when the ratio of g_a and g_b are equal to the ratio of P_a and P_b, which is a similar condition derived when solving factor substitution problems. It implies that the advertising solution will occur when generic and brand advertising levels are used at their best competing levels. This might be a typical case for most agricultural products.

Consumer's Level of Knowledge and δ_0

The consumer's actual knowledge (or information) about the product is determined primarily by the parameter δ_0. This parameter is the major determinant of the level at which the advertising function starts its informative or persuasive role through the use of the advertisements (generic or brand). In other words, it reflects how much the consumer knows about the attributes of an advertised product. The initial level of knowledge can be adjusted to differentiate products that have not been advertised from products that have been highly advertised.

Different levels of information will produce different patterns of adjustments in the advertising function g.

Figure 4.1 shows different patterns of adjustments of the advertising function when different levels of δ_0 are used.

Figure 4.1a shows the case where there is a low level of current initial information (δ_0=2.0),

$$g = 1/(1+e^{\delta_0}) = 1/(1+e^{2}) = .12.$$

Figures 4.1b and 4.1c illustrate the cases where the current initial level of product knowledge is about half of the full information level (g=.5) and the case where the consumer knows the product to be advertised quite well (g=.95).

As can be seen in these examples, the smaller the number identified with δ_0, the larger the initial level of the consumer's current knowledge. A negative number indicates larger consumer's knowledge of the product than a positive number does because advertising is being represented by a reciprocal function.

The relationship of the consumer's current knowledge of a particular product and the level of δ_0 will be very important when simulating with the advertising model. It will allow the evaluation of several situations that are happening, or can happen, in the product market. For example, the effects of advertising two basically similar products, which differ only in the consumer's current knowledge of the products, can be compared. The consumer's response to advertising of a product that has a lot of potential information which has not been delivered to the consumer can be also evaluated.

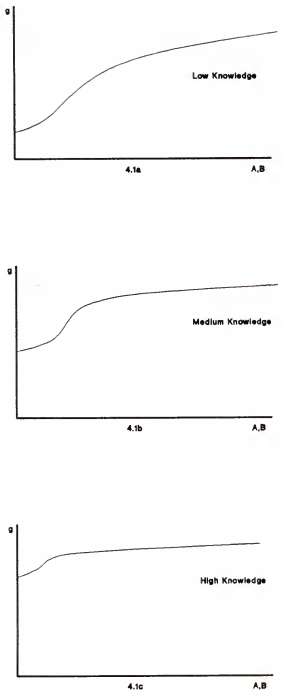

Figure 4.1 Advertising Function with Different Levels of Product Knowledge

Demand and Supply Factors and Elasticities

The demand and supply factors for the advertised product form the second group of factors that play an important role in determining the optimal levels of advertising use from the consumer's and producer's perspective. Their impact in the advertising model is allocated through the adjustments of the advertised product price due to changes of the advertising levels, $(\partial P_X/\partial A)$ and $(\partial P_X/\partial B)$, and through the derived demand for the market product X. In this study, the effects of the structural factors on the optimal levels of generic and brand advertising are represented by the price elasticities of supply and demand. The price elasticities of supply and demand are proxies for the structural market factors because these price elasticities are the ones that directly determine the extent of adjustments of P_X and X.

Theoretically, the main demand factors determining the price elasticity of demand are the availability and closeness of substitutes, the number of product uses, the proportion of income spent on the particular good, and the time period specified for the product.

The main supply factors determining the price elasticity of supply include those factors associated with the short and long run.

Demand Factors and the Price Elasticity of Demand (e_d)

The Availability and Closeness of Substitutes

A close substitute in this study is defined as a product with the capability to imitate and fill the same needs as of any other similar product. Thus, closeness of a substitute product is of crucial importance. The demand for a product is expected to be relatively more price elastic if there are numerous close substitutes for it. For

example, compare coffee and salt. Coffee is expected to be more price elastic than salt. An increase in the price of coffee will drive some coffee drinkers to switch to tea or other soft drinks that are close substitutes for coffee. A similar increase in the price for salt will result in a relatively small change in the quantity of salt consumed due to the lack of close substitutes for salt.

It is also important to consider the definition of the product. The more narrowly and specifically a product is defined, the more close substitutes it has and the more price elastic the demand for it will be. For example, the demand for a Valencia orange will be more elastic than the demand for all oranges.

Number of Product Uses

One way to estimate the number of uses of a product is to classify the product as unprocessed or processed and then calculate the different subproducts under the two categories. The number of uses will be the total sum of processed and unprocessed subproducts counted for the product under consideration.

In general, the larger the number of uses for a product, the greater its demand price elasticity. If a product has only a few uses its demand is likely to be inelastic because the consumer does not have an incentive to buy more of the product since there are not many alternative uses for the product. The various uses of a product can be viewed as if in a hierarchy. If the price of the product is very high, consumers will use the few units they buy only for the most important uses of the commodity. At successively lower prices, more of the product is bought to be devoted to the less important uses.

The Proportion of Income Spent on the Product

This factor is related to the importance of a product in the consumer's budget, where importance is interpreted as the fraction of the total budget that is devoted for a product. The demands for items such as salt and sugar are price inelastic partly because consumers spend only a small proportion of their budgets on them. In contrast, demands for items that account for a large proportion of the consumer's budget are expected to be more price elastic since changes in prices for these expensive products cannot be ignored.

Time Period

The demand for a product always exists in some period of time, which can be a day, a week, a month, a year, or a period of several years. Price elasticity of demand varies with the length of the time period. In general, demand is more elastic (or less inelastic) the longer the period of time. The demand price elasticity is more elastic in the long run because the consumer has more time to adjust to price changes than in the short run. For example, product demands created with weekly data are less price elastic than product demands (same product) using monthly data. The reason is that monthly data reflect more time to adjust to product price changes.

Supply Factors and the Price Elasticity of Supply (e_S)

Short Run

Short run is defined as a period of time where some of the resources used in the production of a commodity are fixed. It also refers to the situation where the production of the product has been completed (i.e., harvested) and the only variable able to affect the

elasticity of supply is the storability of the product. The more storable a product, thee more elastic the supply is expected to be. This is because the producer has the alternative of storing the product to selling it in the market. On the other hand, a perishable product will have an almost perfect inelastic supply because the only choice for the producer is to sell the product.

Long Run

Long run refers to a period of time where all factors used in the production of a commodity can vary. Thus the producers have enough time to adjust the factors of production, including the size of the production unit. In general, the price elasticity of supply will depend on the ease and relative costs of increasing (or decreasing) the production of the product. The easier the process of adjustment in production and/or the more inexpensive the adjustment process, the more elastic the supply should be.

In the long run, the costs of adjusting production are also related to how e_s is impacted by economies (or diseconomies) of scale. An economy of scale is said to exist when larger output is associated with lower average cost. A diseconomy of scale occurs when larger output entails higher average cost. Economies of scale can be classified into real and pecuniary economies. Real economies of scale are those associated with a reduction in the physical quantities of inputs (raw materials, labor, capital, etc.). Pecuniary economies of scale are realized when lower prices are paid for input factors as the firm size increases, and does not imply a necessary reduction in the quantity of input use.

Economies of scale can be further classified into internal and external economies. Internal economies of scale include those factors that are internal to a firm. External economies of scale refer to those economies gained by the whole industry. Factors related to internal economies (or diseconomies) of scale determine the shape of the long run average cost curve and therefore the shape of the long-run supply curve. External economies (or diseconomies) of scale determine mainly the position of the supply curve.

In general, the presence of economies of scale makes the supply curve less steep. Diseconomies of scale, on the other hand, will make it more steep. Thus a product market presenting economies of scale will be expected to have a relatively more elastic supply curve than one showing diseconomies of scale.

Advertising Model Parameters and Their Range of Values

In the previous sections, a detailed description of factors determining the impact of advertising on consumer's behavior in the model was completed. Also, several examples illustrating how the product attributes and market factors are related to the parameters of the advertising model (δ_0, δ_1, δ_2, δ_3, α_1 and β_1) were provided for several agricultural products. This section will define the range of values that these parameters can take based on the theoretical aspects already built into the advertising model.

Parameter δ_0

This parameter represents the current level of the consumer's knowledge about a product. The parameter δ_0 can take any positive or negative value, including the value of zero. Since the level of

knowledge can vary from a minimum of zero to a maximum of one, it is more likely that $-2.0 < \delta_0 < 2.0$. This range will include from a low of 12 percent to a high of 88 percent of the potential knowledge of a product and covers most situations encountered in agricultural products.

Parameters δ_1, δ_2, δ_3, θ_1, and θ_2

As mentioned before, the direct interaction between generic and brand advertising represented by δ_3 is assumed to be zero. There is not much loss to the overall theoretical advertising model since, even with $\delta_3=0$, the interaction between generic and brand advertising is captured in g_{ab} or g_{ba} through the combined effects of g_a, g_b, δ_1 and δ_2.

The generic and the brand advertising parameters, δ_1 and δ_2, are defined and limited in the range of values they can take by the assumptions made on the marginal productivities of generic and brand advertising (g_a and g_b). These marginal productivities are assumed to be positive; that is, there is always some information (real or fancied) for the consumer when a product is advertised through generic or brand promotion. The actual positive value for g_a and g_b depend on the estimated current values of their respective components. Under the conditions of $\delta_3=0$ and of g_a (or g_b) >0, the parameters δ_1 and δ_2 should be negative numbers.

The advertising model developed in this study generates two equations that theoretically can be solved simultaneously for A and B. The parameters θ_1 and θ_2 assure the presence of A and B in the solution of the model. Instead of adding the parameters θ_1 and θ_2 to the advertising function, the same effect could have been obtained using

the parameters δ_1 and δ_2 as powers rather than products to the variables A and B, respectively. Both parameters θ_1 and θ_2 will be valued at 0.5 each.

Price Elasticity of Demand

The simulations of the advertising effects on the consumer's behavior will be completed for agricultural products. Most agricultural products present inelastic demands (Kohls and Uhl, 1985). In this study, the price elasticity of demand will be simulated in the following range of values: $-1.5 > \alpha_1/c > -0.10$. This range of values allows the possibility of some products exhibiting price elastic demands. The actual value of the price elasticity of demand will depend on the presence (or absence) of factors determining the demand elasticity of the product under consideration.

Note that the actual price elasticity of demand (e_d) for product X is α_1/c, where α_1 is the price elasticity of demand for the commodity characteristic Z_i, and $c = g + \alpha_1 g - \alpha_1 \beta_1$. Since this price elasticity (α_1/c) depends on the specific solution of the advertising model (the factor c contains g, which is determined by the model solution), the simulations will be run based on values for α_1.

Price Elasticity of Supply

The price elasticity of supply (e_s) for most agricultural products is also quite inelastic (Kohls and Uhl, 1985). In this study the price elasticity of supply will be simulated in the following range $0.05 < (1/(\beta_1-1)) < 1.5$. The price elasticity of supply, $1/(\beta_1-1)$ was obtained from the marginal cost of production assumed for the producer. Similar

to the case of e_d, the actual value of e_s depends on the dominant factors affecting the supply of the particular product under study.

Standard Measures (Indices)

One of the important objectives for constructing this theoretical model of advertising is to evaluate how well different factors (the product attributes and structural elements) regulate the effects of each type of advertising on the consumer's behavior? To pursue this objective it is necessary to determine some standard measures that allow the comparison of the advertising model adjustments to changes of a single, or a combination of, advertising factors.

In this study, the standard measures to be used come directly from the simultaneous solution of the final system of equations in the advertising model. This system has two equations (equations (49) and (50)) representing the implicit prices for generic and brand advertising, respectively. Each equation has two unknown variables, the optimal levels of generic and brand advertising. Thus, this system of equations can be solved for A and B.

One standard measure is the proportion of generic advertising over the total level of advertising, (A/(A+B)); i.e., a share index. This relative measure facilitates the evaluation of the advertising model when one or more advertising factors are changed for a particular product and is especially useful in comparing the effects of changing a particular product attribute (changes in δ_1 and δ_2).

In addition to the A/(A+B) index, two other measures, the A-index and the B-index are used to compare the simulations of different factor adjustments in the advertising model. The A-index is calculated for

relative changes in generic advertising and the B-index for relative changes in brand advertising in terms of generic advertising. Both indices use a particular case as the standard base of reference from which any adjustment of the optimal levels of generic and brand advertising due to changes in an advertising factor (a product attribute and/or structural factor) can be evaluated.

CHAPTER V

ADVERTISING: A GENERAL CASE

Introduction

A general simulation of the effects of adjustments in product attributes and structural factors on the advertising model is presented in this chapter. This advertising simulation should reflect or imitate the current advertising situations in the market for agricultural products.

Advertising Scenarios

Following is a list of possible scenarios on the use of generic and brand advertising in the marketing of an agricultural product. This list is based on the values that the implicit prices for both types of advertising can take for the consumer and represents situations where generic and/or brand advertising are under, optimally, or oversupplied.

1. $S_a>0$ and $S_b=0$. Generic advertising is undersupplied by the market and brand advertising is optimally supplied.
2. $S_a>0$ and $S_b>0$. Generic and brand advertising are undersupplied by the market.
3. $S_a>0$ and $S_b<0$. Generic advertising is undersupplied and brand advertising is oversupplied by the market.
4. $S_a<0$ and $S_b=0$. Generic advertising is oversupplied and brand advertising is optimally supplied by the market.

5. $S_a<0$ and $S_b>0$. Brand advertising is undersupplied by the market and generic advertising is oversupplied.
6. $S_a<0$ and $S_b<0$. Both generic and brand advertising are oversupplied in the market.
7. $S_a=0$ and $S_b>0$. Generic advertising is being optimally supplied and brand advertising is undersupplied in the market.
8. $S_a=0$ and $S_b<0$. Brand advertising is oversupplied and generic advertising is optimally supplied by the market.
9. $S_a=0$ and $S_b=0$. Both types of advertising are optimally supplied by the market.

The particular scenario (1 to 8) to be used for simulating the adjustments of advertising factors in the advertising model can be selected, in principle, by obtaining the levels of generic and brand advertising under scenario 9, where $S_a=S_b=0$, and then comparing this result to actual levels of generic and brand advertising for the particular product under consideration. In other words, the comparison of the levels of A and B under $S_a=S_b=0$, and the actual levels of A and B encountered for the product in the market, should provide evidence of the under, over, or optimal supply of generic and/or brand advertising.

For those products that producers are currently seeking federal legislative approval to advertise generically, only situations 1, 2, and 3 need to be considered. For example, the levels of generic advertising for these products can be assumed to be undersupplied in the market.

Nonetheless, it should be emphasized that the solution of the model for values of generic and brand advertising depends entirely on the assumptions made when developing the advertising model and, more

specifically, on the assumptions and techniques used to obtain the values of the parameters for model simulation.

An Example of Optimal Levels of Advertising

The case where both generic and brand advertising are optimally supplied (S_a=S_b=0) in the market has been chosen in this study to demonstrate the effects of changing advertising factors, such as product attributes and/or market structural elements, in the advertising model. This case was selected because it is the basic advertising situation against which all other advertising scenarios can be compared. It is also the simplest case among possible scenarios since it has a unique value for the implicit prices of generic and brand advertising (S_a=S_b=0) compared to a range of values for the implicit prices for under or over advertising levels (S_a and $S_b > 0$, or S_a and $S_b < 0$).

A solution for this case study was obtained in two different stages. In the first stage the procedure SIMNLIN, for solving systems of nonlinear simultaneous equations, from the Statistical Analysis System (SAS) program, was used to estimate values of generic and brand advertising resulting in S_a=S_b=0 or approximately equal to zero. This set of values then provided a general guide of the levels of A and B expected to fulfill the assumption of zero values for the implicit prices of generic and brand advertising. The SAS program was chosen in this first stage because it provided the necessary procedures to create a large set of data through the use of do-loops. This data set shows the many different combinations of variables and parameters values that represent a solution of the advertising model. In the second stage the application module 10 from the GAUSS Programming Language, which solves

systems of nonlinear equations using Newton and quasi-Newton algorithms, was utilized to obtain the actual solutions for A and B of the advertising model based on the set of values generated in the first step. The application module 10 of GAUSS produces a result in extended precision of approximately 19 digits of accuracy. This is relatively more accurate than most other mathematical programming packages whose average accuracy level varies from 9 to 14 digits.

After several runs of this two stage procedure, a general arbitrary solution was found under the following parameter values α_0=70, α_1=-1.00, β_0=.50, β_1=2.00, δ_0=2.00, δ_1=-.30, δ_2=-.40, θ_1=.50, θ_2=.50, P_x=\$32.0, P_a=\$1.0 and P_b=\$1.0. The values for α_1 and β_1 reflect unitary elasticity levels for demand and supply. This will be the standard base of reference to evaluate price inelastic supplies and price inelastic demands such as the ones found in agricultural products. The value for δ_0 represent a relatively low level of current knowledge of the product. The values for P_a and P_b will permit the interpretation of the levels of generic and brand advertising as advertising expenditures. The values for the remaining parameters have no special assumptions other than being part of the solution of the model.

The following sections will present the effects of adjustments in supply and demand elasticities, knowledge of the product, price of the product, and perception of generic and brand advertising on the optimal advertising levels of both types of advertising.

Effects of Demand and Supply Elasticities on Generic and Brand Advertising

The effects of changes in supply (e_s) and demand (e_d) elasticities on the expenditure levels of generic and brand advertising are evaluated in this section. The A-index and B-index will be used to compare the effects of these changes on the advertising model. These indices are calculated with the following case, δ_1=-.3, δ_2=-.4, e_s=1.0 and e_d=-1.0, as the standard base of reference; i.e., the A-index at the standard base is obtained dividing generic advertising expenditures into itself (21.10/21.10=1.0), the B-index is calculated dividing brand advertising expenditures into generic advertising expenditures (37.52/21.10=1.78). The A-index represents the index for generic advertising. The B-index represents the index for brand in terms of generic advertising. This definition of the B-index will make the analysis of the relative adjustments of generic, brand, and total advertising easier since the advertising model can now be seen as using one standard unit of advertising.

When using these indices all simulation points are compared to the standard base of reference. For example, a 10 percent change in the price elasticity of demand from -1.0 to -.90, under δ_1=-.3 and δ_2=-.4, generates the following solution: A=23.17 and B=41.20; their respective A-index and B-index will be 23.17/21.10=1.10 and 41.20/21.10=1.95. It says that a 10 percent change in the price elasticity of demand will produce a 10 percent change in both generic (from 1.0 to 1.10) and brand (1.78 to 1.95) advertising expenditure levels compared to the base point.

The range of values simulated for e_d is from -1.50 (elastic) to -0.50 (inelastic). The range of values simulated for e_s is from 1.50 (elastic) to 0.50 (inelastic). All other relevant parameters and variables are being held fixed at the following levels: α_0=70.0, β_0=0.5, δ_0=2.0, δ_1=-0.3, δ_2=-0.4, θ_1=0.5, θ_2=0.5, P_a=\$1.0, P_b=\$1.0 and P_x=\$32.0.

The effects of adjustments in the price elasticity of demand (ceteris paribus) on the levels of generic and brand advertising expenditures can be evaluated from Table 5.1. Starting at the standard base point where e_s=1.0 and e_d=-1.0, a 10 percent increase in $|e_d|$, from -1.00 to -1.10 generates a 9 percent decrease in the index for both generic and brand advertising levels. A 20 percent increase in $|e_d|$, from -1.00 to -1.20 produces an 18 percent decrease in the A-index and the B-index. A 30 percent increase in $|e_d|$, from -1.00 to -1.30 produces a 26 percent decrease in the A-index and the B-index. When the price elasticity of demand becomes less elastic starting at e_d=-1.0, a similar pattern develops between the price elasticity of demand and the indices for A and B. A 10 percent decrease in $|e_d|$, from -1.0 to -.90 generates a 10 percent increase in the A-index and the B-index. A 30 percent decrease in $|e_d|$, from -1.00 to -0.70 augments the level of both indices by 32 percent.

Thus, there is an inverse relationship between the price elasticity of demand and the relative indexed levels of generic and brand advertising. The more price elastic the demand the smaller the relative levels of A and B. In other words, as the demand becomes more price elastic the lower the optimal relative expenditure levels of both

Table 5.1 Effects of Demand and Supply Elasticities on Optimal Levels of Generic and Brand Advertising

e_s	e_d	A[a]	B[b]	A[c] Index A/A∘	B Index B/A∘	Share A/A+B
1.50	-1.50	21.67	38.53	1.03	1.83	0.36
1.50	-1.40	23.15	41.15	1.10	1.95	0.36
1.50	-1.30	24.67	43.86	1.17	2.08	0.36
1.50	-1.20	26.26	46.68	1.24	2.21	0.36
1.50	-1.10	27.93	49.65	1.32	2.35	0.36
1.50	-1.00	29.70	52.79	1.41	2.50	0.36
1.50	-0.90	31.58	56.14	1.50	2.66	0.36
1.50	-0.80	33.60	59.73	1.59	2.83	0.36
1.50	-0.70	35.79	63.62	1.70	3.01	0.36
1.50	-0.60	38.17	67.85	1.81	3.22	0.36
1.50	-0.50	40.78	72.50	1.93	3.44	0.36
1.40	-1.50	19.95	35.46	0.95	1.68	0.36
1.40	-1.40	21.45	38.14	1.02	1.81	0.36
1.40	-1.30	23.01	40.91	1.09	1.94	0.36
1.40	-1.20	24.64	43.80	1.17	2.08	0.36
1.40	-1.10	26.34	46.83	1.25	2.22	0.36
1.40	-1.00	28.15	50.04	1.33	2.37	0.36
1.40	-0.90	30.08	53.47	1.43	2.53	0.36
1.40	-0.80	32.15	57.15	1.52	2.71	0.36
1.40	-0.70	34.40	61.15	1.63	2.90	0.36
1.40	-0.60	36.86	65.53	1.75	3.10	0.36
1.40	-0.50	39.57	70.35	1.88	3.33	0.36
1.30	-1.50	18.20	32.35	0.86	1.53	0.36
1.30	-1.40	19.74	35.10	0.94	1.66	0.36
1.30	-1.30	21.33	37.93	1.01	1.80	0.36
1.30	-1.20	22.99	40.87	1.09	1.94	0.36
1.30	-1.10	24.73	43.96	1.17	2.08	0.36
1.30	-1.00	26.57	47.24	1.26	2.24	0.36
1.30	-0.90	28.54	50.74	1.35	2.40	0.36
1.30	-0.80	30.66	54.51	1.45	2.58	0.36
1.30	-0.70	32.97	58.61	1.56	2.78	0.36
1.30	-0.60	35.50	63.11	1.68	2.99	0.36
1.30	-0.50	38.31	68.11	1.82	3.23	0.36
1.20	-1.50	16.45	29.24	0.78	1.39	0.36
1.20	-1.40	18.03	32.06	0.85	1.52	0.36
1.20	-1.30	19.66	34.94	0.93	1.66	0.36
1.20	-1.20	21.34	37.94	1.01	1.80	0.36
1.20	-1.10	23.11	41.08	1.10	1.95	0.36
1.20	-1.00	24.98	44.41	1.18	2.10	0.36
1.20	-0.90	26.99	47.98	1.28	2.27	0.36
1.20	-0.80	29.15	51.82	1.38	2.46	0.36
1.20	-0.70	31.51	56.02	1.49	2.65	0.36
1.20	-0.60	34.11	60.64	1.62	2.87	0.36
1.20	-0.50	37.01	65.80	1.75	3.12	0.36

Table 5.1--Continued

e_s	e_d	A[a]	B[b]	A[c] Index A/A*	B Index B/A*	Share A/A+B
1.10	-1.50	14.32	25.46	0.68	1.21	0.36
1.10	-1.40	15.96	28.37	0.76	1.34	0.36
1.10	-1.30	17.63	31.34	0.84	1.48	0.36
1.10	-1.20	19.35	34.40	0.92	1.63	0.36
1.10	-1.10	21.15	37.60	1.00	1.78	0.36
1.10	-1.00	23.05	40.99	1.09	1.94	0.36
1.10	-0.90	25.09	44.61	1.19	2.11	0.36
1.10	-0.80	27.30	48.54	1.29	2.30	0.36
1.10	-0.70	29.72	52.83	1.41	2.50	0.36
1.10	-0.60	32.39	57.59	1.53	2.73	0.36
1.10	-0.50	35.39	62.92	1.68	2.98	0.36
1.00	-1.50	12.17	21.64	0.58	1.03	0.36
1.00	-1.40	13.87	24.66	0.66	1.17	0.36
1.00	-1.30	15.58	27.70	0.74	1.31	0.36
1.00	-1.20	17.34	30.83	0.82	1.46	0.36
1.00	-1.10	19.17	34.08	0.91	1.61	0.36
1.00	-1.00	21.10	37.52	1.00	1.78	0.36
1.00	-0.90	23.17	41.20	1.10	1.95	0.36
1.00	-0.80	25.42	45.19	1.20	2.14	0.36
1.00	-0.70	27.88	49.57	1.32	2.35	0.36
1.00	-0.60	30.62	54.43	1.45	2.58	0.36
1.00	-0.50	33.71	59.92	1.60	2.84	0.36
0.90	-1.50	9.82	17.45	0.47	0.83	0.36
0.90	-1.40	11.60	20.62	0.55	0.98	0.36
0.90	-1.30	13.37	23.77	0.63	1.13	0.36
0.90	-1.20	15.16	26.96	0.72	1.28	0.36
0.90	-1.10	17.03	30.27	0.81	1.43	0.36
0.90	-1.00	18.99	33.75	0.90	1.60	0.36
0.90	-0.90	21.08	37.48	1.00	1.78	0.36
0.90	-0.80	23.36	41.52	1.11	1.97	0.36
0.90	-0.70	25.86	45.97	1.23	2.18	0.36
0.90	-0.60	28.65	50.93	1.36	2.41	0.36
0.90	-0.50	31.82	56.57	1.51	2.68	0.36
0.80	-1.50	7.14	12.70	0.34	0.60	0.36
0.80	-1.40	9.06	16.11	0.43	0.76	0.36
0.80	-1.30	10.91	19.39	0.52	0.92	0.36
0.80	-1.20	12.75	22.67	0.60	1.07	0.36
0.80	-1.10	14.65	26.04	0.69	1.23	0.36
0.80	-1.00	16.63	29.57	0.79	1.40	0.36
0.80	-0.90	18.75	33.33	0.89	1.58	0.36
0.80	-0.80	21.05	37.41	1.00	1.77	0.36
0.80	-0.70	23.58	41.91	1.12	1.99	0.36
0.80	-0.60	26.41	46.96	1.25	2.23	0.36
0.80	-0.50	29.66	52.72	1.41	2.50	0.36

Table 5.1--Continued

e_s	e_d	A[a]	B[b]	A[c] Index A/A•	B Index B/A•	Share A/A+B
0.70	-1.50	4.13	7.34	0.20	0.35	0.36
0.70	-1.40	6.25	11.10	0.30	0.53	0.36
0.70	-1.30	8.20	14.58	0.39	0.69	0.36
0.70	-1.20	10.11	17.98	0.48	0.85	0.36
0.70	-1.10	12.05	21.42	0.57	1.01	0.36
0.70	-1.00	14.05	24.98	0.67	1.18	0.36
0.70	-0.90	16.18	28.77	0.77	1.36	0.36
0.70	-0.80	18.49	32.87	0.88	1.56	0.36
0.70	-0.70	21.04	37.40	1.00	1.77	0.36
0.70	-0.60	23.91	42.50	1.13	2.01	0.36
0.70	-0.50	27.21	48.36	1.29	2.29	0.36
0.60	-1.50	1.32	2.35	0.06	0.11	0.36
0.60	-1.40	3.30	5.86	0.16	0.28	0.36
0.60	-1.30	5.34	9.49	0.25	0.45	0.36
0.60	-1.20	7.32	13.01	0.35	0.62	0.36
0.60	-1.10	9.29	16.51	0.44	0.78	0.36
0.60	-1.00	11.31	20.11	0.54	0.95	0.36
0.60	-0.90	13.45	23.91	0.64	1.13	0.36
0.60	-0.80	15.76	28.01	0.75	1.33	0.36
0.60	-0.70	18.30	32.54	0.87	1.54	0.36
0.60	-0.60	21.18	37.65	1.00	1.78	0.36
0.60	-0.50	24.51	43.57	1.16	2.06	0.36
0.50	-1.50	0.21	0.38	0.01	0.02	0.36
0.50	-1.40	0.87	1.54	0.04	0.07	0.36
0.50	-1.30	2.28	4.06	0.11	0.19	0.36
0.50	-1.20	4.12	7.33	0.20	0.35	0.36
0.50	-1.10	6.08	10.80	0.29	0.51	0.36
0.50	-1.00	8.10	14.39	0.38	0.68	0.36
0.50	-0.90	10.22	18.17	0.48	0.86	0.36
0.50	-0.80	12.51	22.24	0.59	1.05	0.36
0.50	-0.70	15.03	26.72	0.71	1.27	0.36
0.50	-0.60	17.88	31.79	0.85	1.51	0.36
0.50	-0.50	21.20	37.70	1.00	1.79	0.36

Note: The numbers in this table have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=2.0, δ_1=-.3, δ_2=-.4, θ_1=.5, θ_2=.5, P_x=$32.0, P_a=$1.0 and P_b=$1.0

[a] A is the level of generic advertising expenditures

[b] B is the level of brand advertising expenditures

[c] $A_\bullet$ is the level of generic advertising expenditures used as the reference base point at e_s=1.0 and e_d=-1.0

generic and brand advertising provided by the market. Both indices also change at a faster rate when the demand becomes more inelastic than when it gets more elastic. For example, a change of $|e_d|$, from -1.00 to -1.50 (a 50 percent increase), decreases the level of both indices by 42 percent; a 50 percent decrease in $|e_d|$, from -1.00 to -.50, increases the A-index and the B-index by 60 percent.

Figure 5.1 presents the adjustments of the A-index and the B-index as the price elasticity of demand changes from -0.50 (inelastic) to -1.50 (elastic), holding the price elasticity of supply at 1.0 (unitary elasticity). The A-index and the B-index show their lowest values at 0.58 and 1.03 when e_d=-1.50, and their highest values at 1.60 and 2.84 when e_d=-0.50. The inverse relationship between the price elasticity of demand and the expenditure levels of advertising (both generic and brand) can be traced back to one of the fundamental theorems of advertising. Dorfman and Steiner (1954) set forth the following advertising theorem: "A firm which can influence the demand for its product by advertising will, in order to maximize its profits, choose the advertising budget and price such that the increase in gross revenue resulting from a one dollar increase in advertising expenditures is equal to the ordinary price elasticity of demand for the firm's product." These authors show that profits to an industry for any given quantity demanded are maximized when,

$$v=|e_d|,$$

where $v=Q_a P$, v is the marginal value product, $Q_a=\partial Q/\partial a$, Q is the demand for a product X, a is the advertising intensity, e_d is the price elasticity of demand, and P is the product price.

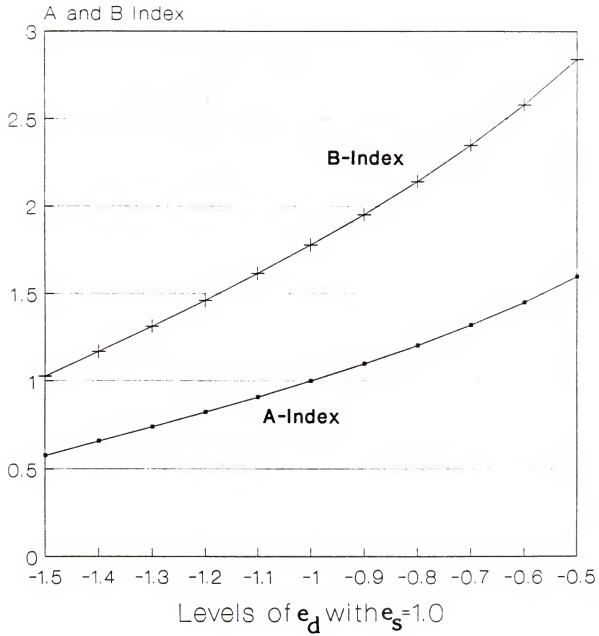

Figure 5.1 Advertising Adjustments to Price Elasticity of Demand with Price Elasticity of Supply at 1.0

Using this advertising theorem and some mathematical manipulation, Ward and Behr (1979) are able to show a clear linkage of the optimal static advertising rule, $v=|e_d|$, to both price and non-price decisions,

$$v = |e_d|,$$

$$(\partial Q/\partial a)\ P = |e_d|,$$

$$(\partial Q/\partial a)(Q/Q)(a/a)(P) = |e_d|,$$

$$(e_a)(Q\ (P/a)) = |e_d|,$$

$$(a/(P\ Q)) = (e_a/|e_d|),$$

$$(a/s) = (e_a/|e_d|).$$

where a/s is the advertising intensity or advertising-sales ratio; and $e_a = (\partial Q/\partial a)(a/Q)$ is the advertising elasticity.

The relationship between advertising intensity (a/s) and the price (e_d) and non-price (e_a) elasticities shows quite clearly the effects of changes in the price elasticity of demand on the advertising expenditures. As e_d becomes more elastic ($|e_d|$ gets larger), the level of advertising expenditures gets smaller (a/s becomes smaller). Also, note that e_a is the other element impacting these advertising levels. The elasticity e_a actually summarizes all those non-price factors (e.g., advertising) used in the marketing of a product. In the advertising model developed in this study, e_a represents the effect of the particular attributes of a product (through δ_1 and δ_2) and the overall current knowledge or information of the product available to the consumers (through δ_0).

The inverse relationship between the e_d and the optimal expenditure levels of generic and brand advertising is also consistent with the classification of a product as experience versus search good

(Nelson, 1974). Experience goods are those products that can be bought and experienced often because they are relatively cheap and account for a relatively small proportion of the consumer's budget. In contrast, search goods are those products which cost quite a bit of money (accounting for a relatively large proportion of the consumer's budget), and the consumer, instead of relying on the information provided by advertising alone, will also search (using any other nonadvertising means) for the attributes or qualities required of the product. Agricultural products are essentially experience goods and, as such, they possess inelastic demands since their consumption is quite stable even when their prices might be volatile. Agricultural products are expected to use larger relative levels of advertising compared to search goods, whose demands are more price elastic, because consumers of agricultural products are more likely to acquire information through advertising since for experience goods it would be too costly to search for the desired attributes of a product in the market.

Table 5.1 also presents the effects of adjustments in the price elasticity of supply (ceteris paribus) on the expenditure levels of generic and brand advertising. A 10 percent increase in e_s, from 1.00 to 1.10, holding e_d=-1.0, increases the A-index and the B-index by 9 percent. A 30 percent increase in e_s, from 1.00 to 1.30, increases both indices by 26 percent. When the price elasticity of supply becomes more inelastic, a similar pattern develops between e_s and the indices for A and B. A 10 percent decrease in e_s, from 1.00 to 0.90, decreases the A-index and the B-index by 10 percent. A 20 percent decrease in e_s, from 1.00 to 0.80, decreases both indices by 21 percent. A 40

percent decrease in e_s, from 1.00 to 0.60, reduces both indices by 46 percent. As in the case for e_d, the rate of change of the indexed advertising values is also greater the more price inelastic the supply. For example, a 50 percent increase in e_s, from 1.00 to 1.50, augments the A-index and the B-index by 41 percent; but a 50 percent decrease in e_s, from 1.00 to 0.50, reduces both indices by 62 percent. In contrast to the inverse relationship between the price elasticity of demand and the indices of generic and brand advertising, the price elasticity of supply is directly related to these expenditures; the more price elastic the supply, the larger the relative expenditures of generic and brand advertising.

Figure 5.2 presents the adjustments of the indices for A and B as the price elasticity of supply changes from 0.50 (inelastic) to 1.50 (elastic), holding the price elasticity of demand at -1.0 (unitary). The A-index and the B-index show their lowest values at 0.38 and 0.68 when e_s=0.50, and their highest value at 1.41 and 2.50 when e_s=1.50. This direct or positive relationship between e_s and advertising (A and B) can be explained using Figure 5.3. In this graph there are two supply curves labeled S_1 and S_2. S_1 represents a relatively inelastic supply compared to S_2. Demand is shown to shift from D_1 to D_2 due to advertising (either generic and/or brand). In the case of S_1, the impact of the use of advertising is mostly in the product price (from P1 to P3), with a relatively small increase in the quantity sold (from Q1 to Q3). In the case of S2, the impact of the advertising use is relatively smaller in price (from P1 to P2) and relatively larger in the quantity sold (from Q1 to Q2), compared to the case of S1. The

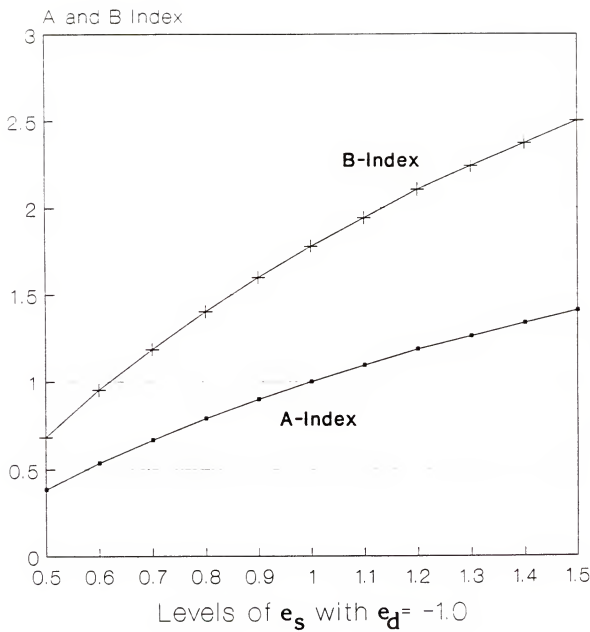

Figure 5.2 Advertising Adjustments to Price Elasticity of Supply with Price Elasticity of Demand at -1.0

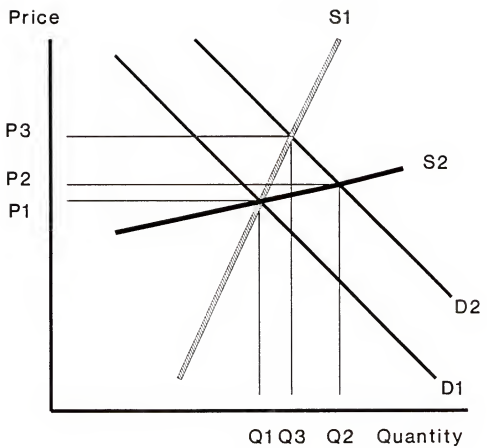

Figure 5.3 Advertising and Price Elasticity of Supply

consumer accepts smaller levels of advertising when the supply is relatively inelastic because the major impact of the use of advertising by the producer is a relatively larger increase in the product price and a smaller increase in the quantity consumed; that is, the use of advertising is perceived by the consumer mainly as an increase in product price.

Table 5.1 also illustrates the effects of combined changes in supply and demand elasticity on the optimal expenditure levels of generic and brand advertising. A 10 percent increase in e_s, from 1.00 to 1.10, and a 10 percent increase in $|e_d|$, from -1.00 to -1.10, produce an A-index and a B-index of 1.00 and 1.78 (i.e., no change in the indices compared to the standard base of reference). A 20 percent increase in e_s, from 1.00 to 1.20, and a 20 percent increase in $|e_d|$, from -1.00 to -1.20, generate an A-index and a B-index of 1.01 and 1.80. The same kind of result is obtained if the e_s and $|e_d|$ are decreased by the same proportions; for example, a 30 percent decrease in e_s, from 1.0 to 0.70, and a 30 percent decrease in $|e_d|$, from -1.0 to -0.70, produce an A-index and a B-index of 1.00 and 1.77. Thus proportional increases (or decreases) in e_s and $|e_d|$ have opposite effects on the relative optimal expenditure levels of generic and brand advertising (measured by the A-index and the B-index).

By the same token, a proportional increase (decrease) in e_s and an equally proportional decrease (increase) in $|e_d|$ will complement each other and produce larger indices. For example, a 20 percent increase in e_s, from 1.00 to 1.20, and a 20 percent decrease in $|e_d|$, from -1.00 to -0.80, increase the A-index and the B-index by 38 percent. As a

matter of fact, any combination of increases (decreases) in e_s and decreases (increases) in $|e_d|$ will generate an increase (decrease) in the A-index and the B-index; e.g., a 30 percent increase in e_s, from 1.00 to 1.30, and a 10 percent decrease in $|e_d|$, from -1.00 to -0.90, increases the A-index and the B-index by 35 percent. Figure 5.4 illustrates the combined effects of different levels of the price elasticity of demand and price elasticity of supply on the A-index and the B-index. The range for e_d is from -0.50 (inelastic) to -1.50 (elastic) and the range for e_s is also from 0.50 (inelastic) to 1.50 (elastic). The lowest values for the A-index and the B-index are 0.01 and 0.02 when e_s=0.50 and e_d=-1.50; i.e., when e_s is most inelastic and e_d is most elastic. The highest values for the A-index and the B-index are 1.93 and 3.44 when e_s=1.50 and e_d= -0.50; i.e., when e_s is most elastic and e_d is most inelastic.

Moreover, the impact on the indices for A and B not only depends on the proportional change in e_s and e_d but also on the actual level of the price elasticity of supply and demand. For example, a 40 percent increase in e_s, from 1.00 to 1.40, and a 10 percent decrease in $|e_d|$, from -1.00 to -0.90, increase the A-index and the B-index by 43 percent. A 40 percent decrease in $|e_d|$, from -1.00 to -0.60, and a 10 percent increase in e_s, from 1.00 to 1.10, increase the A-index and the B-index by 53 percent. Thus, the more price inelastic the demand for a product, the larger the impact on the indices due to adjustments in e_s and/or e_d.

To complete the analysis of the effects of changes in e_d and e_s on the optimal level of generic and brand advertising expenditures, Figure

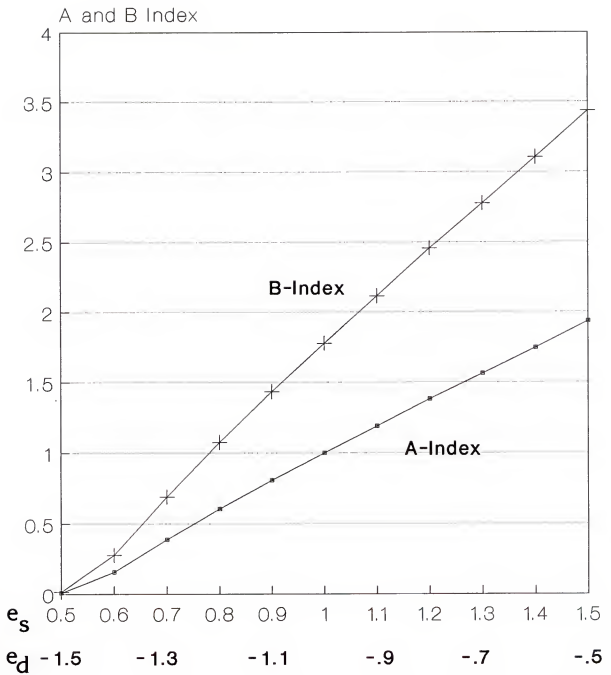

Figure 5.4 Advertising Adjustments to Price Elasticity of Supply and Price Elasticity of Demand

5.5 illustrates the adjustments of the A-index and the B-index as the level of e_d changes from -1.50 (elastic) to -0.50 (inelastic), holding e_s at two different levels, 0.5 and 1.0. The indices for generic and brand advertising are the highest at 1.60 and 2.84 when e_s is most price elastic (1.0) and e_d is most price inelastic (-0.5). Conversely, the smallest advertising indices occur at 0.01 and 0.02 when e_s is most inelastic (0.5) and e_d is most elastic (-1.5). Also, as expected, at e_s=1.0 the levels of both indices generated by changes in e_d are higher than their counterparts at e_s=0.5. Figure 5.6 presents the adjustments of the advertising indices when the role of e_s and e_d have been reversed compared to Figure 5.5; here e_s changes from 0.50 (inelastic) to 1.50 (elastic) and e_d is held fixed at -0.5 and -1.0. As stated before, the levels of the A-index and the B-index generated by changes in e_s are higher at e_d=-0.5 (inelastic) than at e_d=-1.0 (unitary).

Effects of Product Knowledge on Generic and Brand Advertising

Table 5.2 presents the effects of changing the level of the product information on the optimal expenditure levels of generic and brand advertising. As in Table 5.1, the e_s varies from 1.50 (elastic) to 0.50 (inelastic) and the e_d varies from -1.50 (elastic) to -0.50 (inelastic). The level of the knowledge of the product is simulated at three different levels--a low level of 26 percent (δ_0=1.00), a medium level of 50 percent (δ_0=0) and a high level of 73 percent (δ_0=-1.00). The standard base of reference for the A-index and the B-index is the point where e_s=1.00, e_d=-1.00 and δ_0=1.00. At this base point, A=13.82 and B=24.57. All other parameters and variables are held fixed at the same level of Table 5.1.

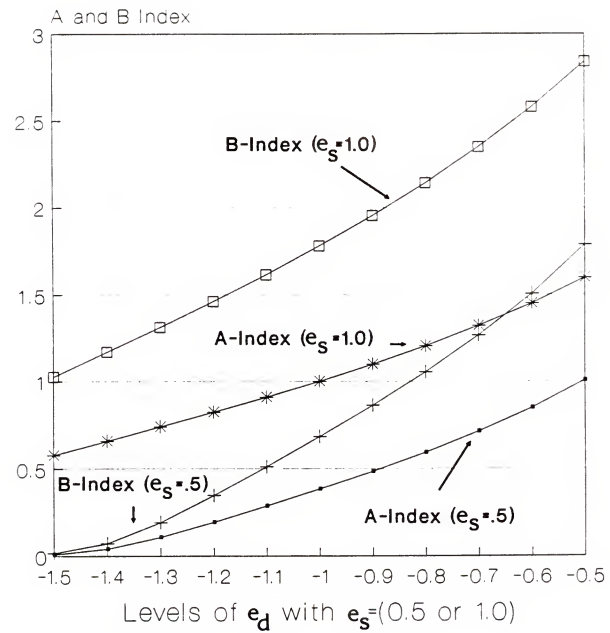

Figure 5.5 Advertising Adjustments to Price Elasticity of Demand with Price Elasticity of Supply at 0.5 and 1.0

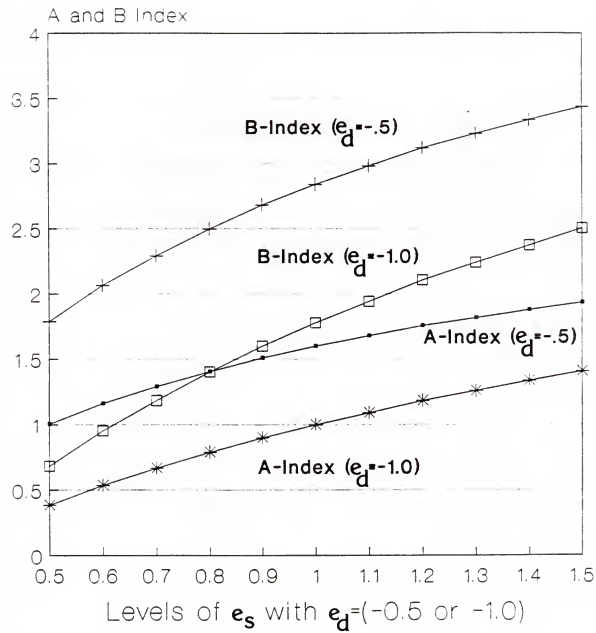

Figure 5.6 Advertising Adjustments to Price Elasticity of Supply with Price Elasticity of Demand at -0.5 and -1.0

Table 5.2 Effects of Demand and Supply Elasticities on Optimal Levels of Generic and Brand Advertising at Different Levels of Product Knowledge

		Level 1[a]				Level 2[b]				Level 3[c]			
e_s	e_d	A	B	A Index A/A*	B Index B/A*	A	B	A Index A/A*	B Index B/A*	A	B	A Index A/A*	B Index B/A*
1.50	-1.50	14.51	25.80	1.05	1.87	8.96	15.93	0.65	1.15	4.96	8.82	0.36	0.64
1.50	-1.40	15.53	27.61	1.12	2.00	9.64	17.13	0.70	1.24	5.38	9.57	0.39	0.69
1.50	-1.30	16.61	29.53	1.20	2.14	10.37	18.44	0.75	1.33	5.85	10.40	0.42	0.75
1.50	-1.20	17.76	31.58	1.29	2.28	11.17	19.86	0.81	1.44	6.37	11.32	0.46	0.82
1.50	-1.10	19.00	33.77	1.37	2.44	12.04	21.41	0.87	1.55	6.94	12.35	0.50	0.89
1.50	-1.00	20.32	36.13	1.47	2.61	13.00	23.11	0.94	1.67	7.59	13.49	0.55	0.98
1.50	-0.90	21.76	38.69	1.57	2.80	14.05	24.98	1.02	1.81	8.31	14.77	0.60	1.07
1.50	-0.80	23.33	41.48	1.69	3.00	15.21	27.05	1.10	1.96	9.12	16.22	0.66	1.17
1.50	-0.70	25.05	44.53	1.81	3.22	16.51	29.34	1.19	2.12	10.04	17.85	0.73	1.29
1.50	-0.60	26.94	47.89	1.95	3.47	17.95	31.92	1.30	2.31	11.09	19.71	0.80	1.43
1.50	-0.50	29.04	51.63	2.10	3.74	19.58	34.81	1.42	2.52	12.28	21.83	0.89	1.58
1.40	-1.50	13.28	23.60	0.96	1.71	8.11	14.42	0.59	1.04	4.42	7.85	0.32	0.57
1.40	-1.40	14.30	25.41	1.03	1.84	8.78	15.60	0.64	1.13	4.82	8.57	0.35	0.62
1.40	-1.30	15.38	27.34	1.11	1.98	9.50	16.89	0.69	1.22	5.27	9.38	0.38	0.68
1.40	-1.20	16.54	29.40	1.20	2.13	10.29	18.29	0.74	1.32	5.78	10.27	0.42	0.74
1.40	-1.10	17.78	31.61	1.29	2.29	11.16	19.83	0.81	1.44	6.34	11.27	0.46	0.82
1.40	-1.00	19.12	34.00	1.38	2.46	12.11	21.53	0.88	1.56	6.97	12.40	0.50	0.90
1.40	-0.90	20.58	36.59	1.49	2.65	13.17	23.41	0.95	1.69	7.69	13.67	0.56	0.99
1.40	-0.80	22.18	39.43	1.60	2.85	14.34	25.49	1.04	1.84	8.50	15.11	0.61	1.09
1.40	-0.70	23.93	42.55	1.73	3.08	15.65	27.83	1.13	2.01	9.42	16.75	0.68	1.21
1.40	-0.60	25.88	46.01	1.87	3.33	17.13	30.45	1.24	2.20	10.48	18.63	0.76	1.35
1.40	-0.50	28.06	49.88	2.03	3.61	18.81	33.43	1.36	2.42	11.70	20.81	0.85	1.51
1.30	-1.50	12.05	21.43	0.87	1.55	7.29	12.96	0.53	0.94	3.90	6.94	0.28	0.50
1.30	-1.40	13.07	23.23	0.95	1.68	7.93	14.11	0.57	1.02	4.29	7.62	0.31	0.55
1.30	-1.30	14.15	25.16	1.02	1.82	8.64	15.37	0.63	1.11	4.72	8.39	0.34	0.61
1.30	-1.20	15.31	27.22	1.11	1.97	9.42	16.75	0.68	1.21	5.20	9.25	0.38	0.67
1.30	-1.10	16.56	29.44	1.20	2.13	10.28	18.27	0.74	1.32	5.75	10.22	0.42	0.74
1.30	-1.00	17.91	31.85	1.30	2.30	11.22	19.96	0.81	1.44	6.37	11.32	0.46	0.82
1.30	-0.90	19.39	34.47	1.40	2.49	12.28	21.83	0.89	1.58	7.07	12.57	0.51	0.91
1.30	-0.80	21.01	37.34	1.52	2.70	13.46	23.92	0.97	1.73	7.88	14.00	0.57	1.01
1.30	-0.70	22.79	40.52	1.65	2.93	14.78	26.28	1.07	1.90	8.80	15.64	0.64	1.13
1.30	-0.60	24.79	44.07	1.79	3.19	16.29	28.95	1.18	2.10	9.86	17.54	0.71	1.27
1.30	-0.50	27.03	48.05	1.96	3.48	18.00	32.01	1.30	2.32	11.11	19.75	0.80	1.43
1.20	-1.50	10.86	19.31	0.79	1.40	6.50	11.55	0.47	0.84	3.42	6.08	0.25	0.44
1.20	-1.40	11.87	21.10	0.86	1.53	7.13	12.67	0.52	0.92	3.78	6.73	0.27	0.49

Table 5.2--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A*	Level 1[a] B Index B/A*	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A*	Level 2[b] B Index B/A*	Level 3[c] A	Level 3[c] B	Level 3[c] A Index A/A*	Level 3[c] B Index B/A*
1.20	-1.30	12.95	23.01	0.94	1.67	7.81	13.89	0.57	1.01	4.19	7.45	0.30	0.54
1.20	-1.20	14.10	25.07	1.02	1.81	8.57	15.24	0.62	1.10	4.66	8.28	0.34	0.60
1.20	-1.10	15.35	27.29	1.11	1.97	9.42	16.74	0.68	1.21	5.18	9.22	0.38	0.67
1.20	-1.00	16.71	29.70	1.21	2.15	10.35	18.40	0.75	1.33	5.78	10.28	0.42	0.74
1.20	-0.90	18.19	32.34	1.32	2.34	11.40	20.26	0.82	1.47	6.47	11.50	0.47	0.83
1.20	-0.80	19.83	35.25	1.43	2.55	12.58	22.36	0.91	1.62	7.26	12.91	0.53	0.93
1.20	-0.70	21.64	38.47	1.57	2.78	13.91	24.73	1.01	1.79	8.18	14.54	0.59	1.05
1.20	-0.60	23.68	42.09	1.71	3.05	15.43	27.43	1.12	1.99	9.25	16.44	0.67	1.19
1.20	-0.50	25.98	46.18	1.88	3.34	17.18	30.55	1.24	2.21	10.51	18.68	0.76	1.35
1.10	-1.50	9.46	16.82	0.68	1.22	5.60	9.96	0.41	0.72	2.88	5.13	0.21	0.37
1.10	-1.40	10.45	18.59	0.76	1.34	6.20	11.02	0.45	0.80	3.22	5.72	0.23	0.41
1.10	-1.30	11.52	20.48	0.83	1.48	6.86	12.19	0.50	0.88	3.60	6.40	0.26	0.46
1.10	-1.20	12.66	22.51	0.92	1.63	7.59	13.49	0.55	0.98	4.03	7.17	0.29	0.52
1.10	-1.10	13.91	24.72	1.01	1.79	8.41	14.94	0.61	1.08	4.53	8.05	0.33	0.58
1.10	-1.00	15.26	27.13	1.10	1.96	9.32	16.57	0.67	1.20	5.10	9.07	0.37	0.66
1.10	-0.90	16.75	29.77	1.21	2.15	10.35	18.40	0.75	1.33	5.77	10.25	0.42	0.74
1.10	-0.80	18.39	32.70	1.33	2.37	11.52	20.48	0.83	1.48	6.54	11.62	0.47	0.84
1.10	-0.70	20.23	35.97	1.46	2.60	12.85	22.85	0.93	1.65	7.44	13.22	0.54	0.96
1.10	-0.60	22.31	39.66	1.61	2.87	14.39	25.58	1.04	1.85	8.50	15.11	0.62	1.09
1.10	-0.50	24.67	43.86	1.79	3.17	16.17	28.75	1.17	2.08	9.77	17.37	0.71	1.26
1.00	-1.50	8.11	14.42	0.59	1.04	4.76	8.46	0.34	0.61	2.40	4.26	0.17	0.31
1.00	-1.40	9.08	16.14	0.66	1.17	5.32	9.45	0.38	0.68	2.70	4.80	0.20	0.35
1.00	-1.30	10.12	18.00	0.73	1.30	5.94	10.57	0.43	0.76	3.05	5.42	0.22	0.39
1.00	-1.20	11.25	20.00	0.81	1.45	6.64	11.81	0.48	0.85	3.45	6.13	0.25	0.44
1.00	-1.10	12.48	22.18	0.90	1.61	7.43	13.20	0.54	0.96	3.91	6.96	0.28	0.50
1.00	-1.00	13.82	24.57	1.00	1.78	8.31	14.78	0.60	1.07	4.45	7.92	0.32	0.57
1.00	-0.90	15.30	27.20	1.11	1.97	9.32	16.57	0.67	1.20	5.08	9.04	0.37	0.65
1.00	-0.80	16.95	30.13	1.23	2.18	10.47	18.61	0.76	1.35	5.83	10.36	0.42	0.75
1.00	-0.70	18.80	33.42	1.36	2.42	11.79	20.96	0.85	1.52	6.70	11.92	0.49	0.86
1.00	-0.60	20.90	37.16	1.51	2.69	13.33	23.70	0.96	1.71	7.75	13.78	0.56	1.00
1.00	-0.50	23.32	41.46	1.69	3.00	15.14	26.91	1.10	1.95	9.02	16.04	0.65	1.16
0.90	-1.50	6.72	11.94	0.49	0.86	3.92	6.97	0.28	0.50	1.93	3.43	0.14	0.25
0.90	-1.40	7.65	13.61	0.55	0.98	4.44	7.89	0.32	0.57	2.20	3.91	0.16	0.28
0.90	-1.30	8.67	15.41	0.63	1.11	5.02	8.92	0.36	0.65	2.51	4.46	0.18	0.32
0.90	-1.20	9.77	17.36	0.71	1.26	5.67	10.09	0.41	0.73	2.87	5.10	0.21	0.37
0.90	-1.10	10.97	19.50	0.79	1.41	6.42	11.41	0.46	0.83	3.29	5.86	0.24	0.42
0.90	-1.00	12.29	21.84	0.89	1.58	7.26	12.91	0.53	0.93	3.79	6.74	0.27	0.49
0.90	-0.90	13.75	24.45	1.00	1.77	8.23	14.64	0.60	1.06	4.38	7.79	0.32	0.56

Table 5.2--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A*	Level 1[a] B Index B/A*	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A*	Level 2[b] B Index B/A*	Level 3[c] A	Level 3[c] B	Level 3[c] A Index A/A*	Level 3[c] B Index B/A*
0.90	-0.80	15.39	27.36	1.11	1.98	9.35	16.63	0.68	1.20	5.09	9.04	0.37	0.65
0.90	-0.70	17.24	30.65	1.25	2.22	10.65	18.94	0.77	1.37	5.93	10.54	0.43	0.76
0.90	-0.60	19.36	34.42	1.40	2.49	12.18	21.65	0.88	1.57	6.95	12.36	0.50	0.89
0.90	-0.50	21.82	38.79	1.58	2.81	14.00	24.88	1.01	1.80	8.21	14.59	0.59	1.06
0.80	-1.50	5.28	9.38	0.38	0.68	3.09	5.50	0.22	0.40	1.49	2.64	0.11	0.19
0.80	-1.40	6.16	10.96	0.45	0.79	3.55	6.31	0.26	0.46	1.71	3.05	0.12	0.22
0.80	-1.30	7.13	12.68	0.52	0.92	4.08	7.25	0.29	0.52	1.98	3.52	0.14	0.25
0.80	-1.20	8.19	14.55	0.59	1.05	4.68	8.31	0.34	0.60	2.30	4.08	0.17	0.30
0.80	-1.10	9.34	16.61	0.68	1.20	5.36	9.54	0.39	0.69	2.67	4.75	0.19	0.34
0.80	-1.00	10.63	18.89	0.77	1.37	6.16	10.95	0.45	0.79	3.12	5.55	0.23	0.40
0.80	-0.90	12.06	21.44	0.87	1.55	7.08	12.58	0.51	0.91	3.66	6.51	0.26	0.47
0.80	-0.80	13.67	24.31	0.99	1.76	8.15	14.48	0.59	1.05	4.31	7.66	0.31	0.55
0.80	-0.70	15.51	27.57	1.12	2.00	9.41	16.72	0.68	1.21	5.11	9.08	0.37	0.66
0.80	-0.60	17.63	31.34	1.28	2.27	10.91	19.39	0.79	1.40	6.09	10.82	0.44	0.78
0.80	-0.50	20.11	35.76	1.46	2.59	12.71	22.60	0.92	1.64	7.31	12.99	0.53	0.94
0.70	-1.50	3.85	6.85	0.28	0.50	2.31	4.10	0.17	0.30	1.08	1.93	0.08	0.14
0.70	-1.40	4.66	8.29	0.34	0.60	2.70	4.80	0.20	0.35	1.27	2.25	0.09	0.16
0.70	-1.30	5.56	9.88	0.40	0.71	3.16	5.61	0.23	0.41	1.49	2.64	0.11	0.19
0.70	-1.20	6.55	11.64	0.47	0.84	3.69	6.56	0.27	0.47	1.75	3.11	0.13	0.23
0.70	-1.10	7.65	13.59	0.55	0.98	4.31	7.65	0.31	0.55	2.07	3.68	0.15	0.27
0.70	-1.00	8.87	15.77	0.64	1.14	5.03	8.94	0.36	0.65	2.46	4.37	0.18	0.32
0.70	-0.90	10.25	18.23	0.74	1.32	5.88	10.45	0.43	0.76	2.93	5.22	0.21	0.38
0.70	-0.80	11.82	21.01	0.86	1.52	6.88	12.23	0.50	0.88	3.52	6.26	0.25	0.45
0.70	-0.70	13.62	24.21	0.99	1.75	8.08	14.36	0.58	1.04	4.25	7.55	0.31	0.55
0.70	-0.60	15.72	27.94	1.14	2.02	9.53	16.93	0.69	1.23	5.17	9.18	0.37	0.66
0.70	-0.50	18.20	32.36	1.32	2.34	11.30	20.09	0.82	1.45	6.33	11.26	0.46	0.81
0.60	-1.50	2.56	4.54	0.18	0.33	1.62	2.87	0.12	0.21	0.75	1.33	0.05	0.10
0.60	-1.40	3.25	5.78	0.24	0.42	1.94	3.44	0.14	0.25	0.89	1.58	0.06	0.11
0.60	-1.30	4.04	7.19	0.29	0.52	2.31	4.11	0.17	0.30	1.06	1.88	0.08	0.14
0.60	-1.20	4.94	8.78	0.36	0.64	2.76	4.91	0.20	0.36	1.27	2.25	0.09	0.16
0.60	-1.10	5.95	10.58	0.43	0.77	3.30	5.86	0.24	0.42	1.53	2.72	0.11	0.20
0.60	-1.00	7.10	12.62	0.51	0.91	3.93	6.99	0.28	0.51	1.85	3.29	0.13	0.24
0.60	-0.90	8.40	14.93	0.61	1.08	4.69	8.34	0.34	0.60	2.25	4.00	0.16	0.29
0.60	-0.80	9.89	17.59	0.72	1.27	5.61	9.97	0.41	0.72	2.76	4.90	0.20	0.35
0.60	-0.70	11.63	20.68	0.84	1.50	6.72	11.94	0.49	0.86	3.40	6.05	0.25	0.44
0.60	-0.60	13.68	24.31	0.99	1.76	8.09	14.37	0.59	1.04	4.24	7.53	0.31	0.54
0.60	-0.50	16.13	28.68	1.17	2.07	9.79	17.41	0.71	1.26	5.32	9.46	0.39	0.68

Table 5.2--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A∘	Level 1[a] B Index B/A∘	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A∘	Level 2[b] B Index B/A∘	Level 3[c] A	Level 3[c] B	Level 3[c] A Index A/A∘	Level 3[c] B Index B/A∘
0.50	-1.50	1.38	2.46	0.10	0.18	0.99	1.76	0.07	0.13	0.45	0.81	0.03	0.06
0.50	-1.40	1.90	3.37	0.14	0.24	1.22	2.18	0.09	0.16	0.55	0.98	0.04	0.07
0.50	-1.30	2.53	4.49	0.18	0.32	1.51	2.68	0.11	0.19	0.67	1.19	0.05	0.09
0.50	-1.20	3.27	5.81	0.24	0.42	1.85	3.30	0.13	0.24	0.82	1.46	0.06	0.11
0.50	-1.10	4.14	7.36	0.30	0.53	2.28	4.05	0.16	0.29	1.01	1.80	0.07	0.13
0.50	-1.00	5.15	9.16	0.37	0.66	2.80	4.97	0.20	0.36	1.26	2.23	0.09	0.16
0.50	-0.90	6.33	11.26	0.46	0.81	3.44	6.11	0.25	0.44	1.57	2.79	0.11	0.20
0.50	-0.80	7.71	13.70	0.56	0.99	4.23	7.51	0.31	0.54	1.98	3.51	0.14	0.25
0.50	-0.70	9.33	16.59	0.68	1.20	5.21	9.26	0.38	0.67	2.51	4.46	0.18	0.32
0.50	-0.60	11.27	20.04	0.82	1.45	6.45	11.46	0.47	0.83	3.22	5.73	0.23	0.41
0.50	-0.50	13.65	24.26	0.99	1.76	8.03	14.28	0.58	1.03	4.19	7.44	0.30	0.54

[a]The numbers in Level 1 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=1.0, δ_1=-.3, δ_2=-.4, θ_1=.5, θ_2=.5, P_x=$32.0, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=1.0, e_d=-1 and δ_0=1.0

[b]The numbers in Level 2 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=0, δ_1=-.3, δ_2=-.4, θ_1=.5, θ_2=.5, P_x=$32.0, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=1.0, e_d=-1 and δ_0=1.0

[c]The numbers in Level 3 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=-1.0, δ_1=-.3, δ_2=-.4, θ_1=.5, θ_2=.5, P_x=$32.0, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=1.0, e_d=-1 and δ_0=1.0

As the knowledge of the product is increased from 26 to 50 percent, the A-index and B-index decrease by 40 percent (from 1.00 to 0.60 and from 1.78 to 1.07, respectively). If the knowledge of the product is increased through advertising even more, from 26 to 73 percent, the A-index and the B-index will decrease by 68 percent (from 1.00 to 0.32 and from 1.78 to 0.57, respectively). This inverse relationship between the level of the current knowledge of the product and the levels of generic and brand advertising can be explained by noting that since there is a finite total amount of product information, the more informed the consumer is about a product the smaller the amount of product information that can be provided through advertising, and therefore, the smaller the quantities of generic and brand advertising needed to reach the optimal advertising levels.

Also, Table 5.2 presents the combined effects of changing e_s, e_d and δ_0 on the optimal advertising expenditure levels. For example, as e_s and δ_0 are held fixed at 1.00 and 1.00, and at the same time e_d changes from inelastic (-0.50) to elastic (-1.50), the A-index and B-index change from maximum values of 1.69 and 3.00 to minimum values of 0.59 and 1.04. As the level of current knowledge increases to δ_0=0 and e_d changes from -0.50 to -1.50, the A-index and B-index levels adjust from maximum values of 1.10 and 1.95 to minimum values of 0.34 and 0.61. If the product knowledge is increased even more to $|\delta_0|$=-1.00 and e_d changes from -0.50 to -1.50, the indices for A and B change from maximum values of 0.65 and 1.16 to minimum values of 0.17 and 0.31.

These adjustments of the A-index and B-index when both e_d and δ_0 change are illustrated in Figure 5.7. It shows the adjustments of the

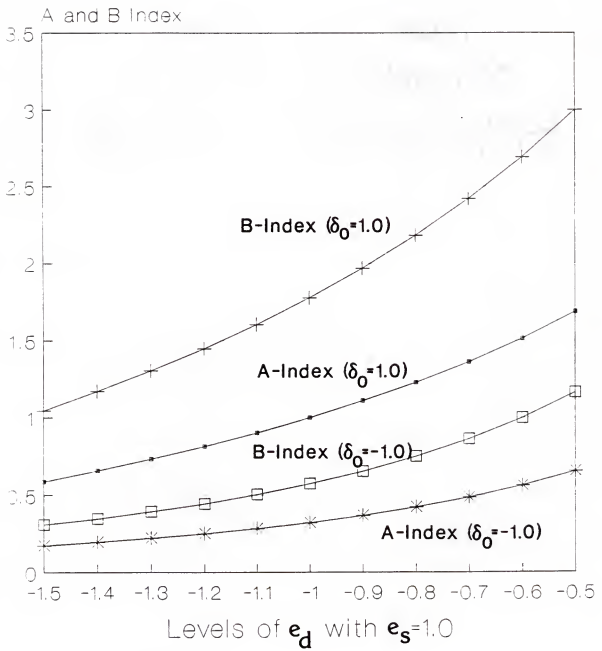

Figure 5.7 Advertising Adjustments to Product Knowledge and Price Elasticity of Demand

indices for A and B as e_d changes from -0.50 (inelastic) to -1.50 (elastic), the parameter δ_0 is held fixed at two different levels, 1.0 (low level of product knowledge) and -1.0 (high level of product knowledge), and e_s is fixed at 1.0 (unitary). The A-index and the B-index are higher when the consumer's knowledge of the product is relatively small. All these results are also consistent with the findings in Table 5.1; that is the price elasticity of demand and the expenditure levels of generic and brand advertising are inversely related. Furthermore, the adjustments on e_d have a relatively smaller impact on the levels of A and B when the consumers are quite informed about the product. For example, a decrease in $|e_d|$, from -1.0 to -0.50, holding e_s at 1.00 and at 23 percent of product knowledge (δ_0 =1.0), increases the A-index and B-index by 69 percent. The same decrease in $|e_d|$, holding e_s at 1.00 and increasing the product knowledge to 73 percent (δ_0=-1.0), increases the A-index and the B-index by only 33 percent.

Similarly, when e_d and δ_0 are held fixed at -1.00 and 1.00, and e_s is adjusted from 0.50 (inelastic) to 1.50 (elastic), the indices for A and B will adjust from minimum values of 0.37 and 0.66 to maximum values of 1.47 and 2.61. As the level of product knowledge increases to δ_0=0 and e_s varies from 0.50 to 1.50, holding e_d at -1.0, the A-index and the B-index change from low values of 0.20 and 0.36 to high values of 0.94 and 1.67. If the product knowledge increases even more to $|\delta_0|$=-1.0 and e_s also varies from 0.50 to 1.50, holding e_d at -1.0, the A-index and the B-index adjust from minimum values of 0.09 and 0.16 to maximum values of 0.55 and 0.98.

These adjustments of the A-index and the B-index when e_s and δ_0 change are now illustrated in Figure 5.8. The indices for A and B at all levels of e_s are relatively lower when the product knowledge is large (73 percent) than when it is low (23 percent). These results are also consistent with the previous finding, where the price elasticity of supply and the expenditure levels of generic and brand advertising are directly related.

This analysis of the effects of the consumer's knowledge of a product indicate that marketing policies directed to influence the levels of advertising through changes in e_s or e_d will not be as effective when the consumer's information about a particular product is relatively high.

Effects of Generic and Brand Advertising on Product Price

The adjustments of product prices and levels of generic and brand advertising expenditures are presented in Table 5.3. As in Table 5.1, e_s varies from 1.50 (elastic) to 0.50 (inelastic) and e_d varies from -1.50 (elastic) to -0.50 (inelastic). The level of the product price has been simulated at three different levels--$32.0, $40.0 and $48.0. The standard base of reference for the A-index and B-index is the point where e_s=1.0, e_d=-1.0 and P_x=$32.0.

A 25 percent increase in the price of the product, from $32.0 to $40.0, increases the indices for A (from 1.0 to 1.12) and B (from 1.78 to 1.98) by 12 percent. A 50 percent increase in P_x, from $32.0 to $48.0, increases the A-index and the B-index from 1.0 to 1.21 and from 1.78 to 2.16, respectively (an increase of 21 percent for both indices). The A-index and the B-index show that increases in the price

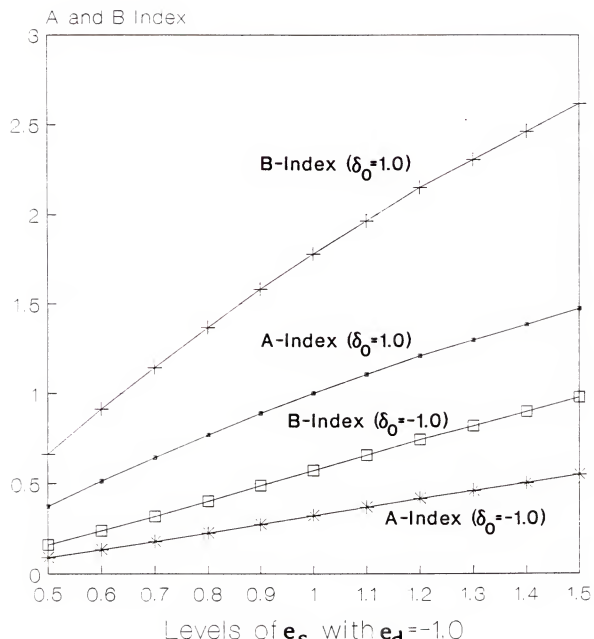

Figure 5.8 Advertising Adjustments to Product Knowledge and Price Elasticity of Supply

Table 5.3 Effects of the Product Price on Generic and Brand Advertising

		Level 1[a]				Level 2[b]				Level 3[c]			
e_s	e_d	A	B	A Index	B Index	A	B	A Index	B Index	A	B	A Index	B Index
				A/A*	B/A*			A/A*	B/A*			A/A*	B/A*
1.50	-1.50	21.67	38.53	1.03	1.83	24.28	43.16	1.15	2.05	26.57	47.23	1.26	2.24
1.50	-1.40	23.15	41.15	1.10	1.95	25.72	45.72	1.22	2.17	27.99	49.77	1.33	2.36
1.50	-1.30	24.67	43.86	1.17	2.08	27.22	48.40	1.29	2.29	29.49	52.43	1.40	2.48
1.50	-1.20	26.26	46.68	1.24	2.21	28.80	51.21	1.36	2.43	31.07	55.24	1.47	2.62
1.50	-1.10	27.93	49.65	1.32	2.35	30.48	54.18	1.44	2.57	32.75	58.23	1.55	2.76
1.50	-1.00	29.70	52.79	1.41	2.50	32.26	57.35	1.53	2.72	34.55	61.42	1.64	2.91
1.50	-0.90	31.58	56.14	1.50	2.66	34.17	60.74	1.62	2.88	36.48	64.85	1.73	3.07
1.50	-0.80	33.60	59.73	1.59	2.83	36.22	64.40	1.72	3.05	38.56	68.56	1.83	3.25
1.50	-0.70	35.79	63.62	1.70	3.01	38.45	68.36	1.82	3.24	40.83	72.59	1.93	3.44
1.50	-0.60	38.17	67.85	1.81	3.22	40.90	72.70	1.94	3.44	43.32	77.01	2.05	3.65
1.50	-0.50	40.78	72.50	1.93	3.44	43.59	77.48	2.07	3.67	46.06	81.89	2.18	3.88
1.40	-1.50	19.95	35.46	0.95	1.68	22.53	40.06	1.07	1.90	24.79	44.07	1.17	2.09
1.40	-1.40	21.45	38.14	1.02	1.81	24.00	42.67	1.14	2.02	26.24	46.65	1.24	2.21
1.40	-1.30	23.01	40.91	1.09	1.94	25.54	45.40	1.21	2.15	27.76	49.36	1.32	2.34
1.40	-1.20	24.64	43.80	1.17	2.08	27.15	48.26	1.29	2.29	29.37	52.22	1.39	2.47
1.40	-1.10	26.34	46.83	1.25	2.22	28.85	51.29	1.37	2.43	31.09	55.26	1.47	2.62
1.40	-1.00	28.15	50.04	1.33	2.37	30.67	54.53	1.45	2.58	32.92	58.52	1.56	2.77
1.40	-0.90	30.08	53.47	1.43	2.53	32.62	57.99	1.55	2.75	34.89	62.02	1.65	2.94
1.40	-0.80	32.15	57.15	1.52	2.71	34.73	61.74	1.65	2.93	37.03	65.82	1.75	3.12
1.40	-0.70	34.40	61.15	1.63	2.90	37.02	65.82	1.75	3.12	39.36	69.97	1.87	3.32
1.40	-0.60	36.86	65.53	1.75	3.10	39.55	70.30	1.87	3.33	41.93	74.54	1.99	3.53
1.40	-0.50	39.57	70.35	1.88	3.33	42.34	75.26	2.01	3.57	44.78	79.61	2.12	3.77
1.30	-1.50	18.20	32.35	0.86	1.53	20.93	37.20	0.99	1.76	23.16	41.17	1.10	1.95
1.30	-1.40	19.74	35.10	0.94	1.66	22.42	39.86	1.06	1.89	24.63	43.78	1.17	2.07
1.30	-1.30	21.33	37.93	1.01	1.80	23.98	42.63	1.14	2.02	26.17	46.53	1.24	2.20
1.30	-1.20	22.99	40.87	1.09	1.94	25.61	45.54	1.21	2.16	27.80	49.43	1.32	2.34
1.30	-1.10	24.73	43.96	1.17	2.08	27.35	48.62	1.30	2.30	29.54	52.52	1.40	2.49
1.30	-1.00	26.57	47.24	1.26	2.24	29.19	51.90	1.38	2.46	31.40	55.82	1.49	2.65
1.30	-0.90	28.54	50.74	1.35	2.40	31.18	55.43	1.48	2.63	33.41	59.39	1.58	2.81
1.30	-0.80	30.66	54.51	1.45	2.58	33.33	59.25	1.58	2.81	35.59	63.26	1.69	3.00
1.30	-0.70	32.97	58.61	1.56	2.78	35.68	63.43	1.69	3.01	37.97	67.51	1.80	3.20
1.30	-0.60	35.50	63.11	1.68	2.99	38.27	68.03	1.81	3.22	40.61	72.20	1.92	3.42
1.30	-0.50	38.31	68.11	1.82	3.23	41.15	73.15	1.95	3.47	43.55	77.43	2.06	3.67
1.20	-1.50	16.45	29.24	0.78	1.39	19.15	34.05	0.91	1.61	21.36	37.97	1.01	1.80
1.20	-1.40	18.03	32.06	0.85	1.52	20.68	36.76	0.98	1.74	22.85	40.62	1.08	1.92
1.20	-1.30	19.66	34.94	0.93	1.66	22.26	39.57	1.05	1.88	24.41	43.40	1.16	2.06
1.20	-1.20	21.34	37.94	1.01	1.80	23.92	42.52	1.13	2.01	26.07	46.34	1.24	2.20

Table 5.3--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A*	Level 1[a] B Index B/A*	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A*	Level 2[b] B Index B/A*	Level 3[c] A	Level 3[c] B	Level 3[c] A Index A/A*	Level 3[c] B Index B/A*
1.20	-1.10	23.11	41.08	1.10	1.95	25.68	45.65	1.22	2.16	27.83	49.47	1.32	2.34
1.20	-1.00	24.98	44.41	1.18	2.10	27.55	48.99	1.31	2.32	29.71	52.83	1.41	2.50
1.20	-0.90	26.99	47.98	1.28	2.27	29.57	52.58	1.40	2.49	31.75	56.45	1.50	2.67
1.20	-0.80	29.15	51.82	1.38	2.46	31.77	56.47	1.51	2.68	33.98	60.40	1.61	2.86
1.20	-0.70	31.51	56.02	1.49	2.65	34.17	60.74	1.62	2.88	36.42	64.74	1.73	3.07
1.20	-0.60	34.11	60.64	1.62	2.87	36.83	65.47	1.75	3.10	39.13	69.56	1.85	3.30
1.20	-0.50	37.01	65.80	1.75	3.12	39.80	70.75	1.89	3.35	42.16	74.96	2.00	3.55
1.10	-1.50	14.32	25.46	0.68	1.21	17.01	30.25	0.81	1.43	19.19	34.12	0.91	1.62
1.10	-1.40	15.96	28.37	0.76	1.34	18.57	33.02	0.88	1.56	20.71	36.82	0.98	1.74
1.10	-1.30	17.63	31.34	0.84	1.48	20.18	35.88	0.96	1.70	22.30	39.64	1.06	1.88
1.10	-1.20	19.35	34.40	0.92	1.63	21.87	38.88	1.04	1.84	23.97	42.62	1.14	2.02
1.10	-1.10	21.15	37.60	1.00	1.78	23.66	42.06	1.12	1.99	25.76	45.79	1.22	2.17
1.10	-1.00	23.05	40.99	1.09	1.94	25.56	45.44	1.21	2.15	27.67	49.19	1.31	2.33
1.10	-0.90	25.09	44.61	1.19	2.11	27.62	49.10	1.31	2.33	29.74	52.87	1.41	2.51
1.10	-0.80	27.30	48.54	1.29	2.30	29.85	53.07	1.41	2.51	32.00	56.90	1.52	2.70
1.10	-0.70	29.72	52.83	1.41	2.50	32.31	57.44	1.53	2.72	34.50	61.34	1.63	2.91
1.10	-0.60	32.39	57.59	1.53	2.73	35.04	62.30	1.66	2.95	37.29	66.29	1.77	3.14
1.10	-0.50	35.39	62.92	1.68	2.98	38.12	67.76	1.81	3.21	40.43	71.87	1.92	3.41
1.00	-1.50	12.17	21.64	0.58	1.03	14.86	26.42	0.70	1.25	17.02	30.25	0.81	1.43
1.00	-1.40	13.87	24.66	0.66	1.17	16.46	29.26	0.78	1.39	18.56	33.00	0.88	1.56
1.00	-1.30	15.58	27.70	0.74	1.31	18.10	32.18	0.86	1.52	20.17	35.86	0.96	1.70
1.00	-1.20	17.34	30.83	0.82	1.46	19.81	35.23	0.94	1.67	21.87	38.88	1.04	1.84
1.00	-1.10	19.17	34.08	0.91	1.61	21.62	38.44	1.02	1.82	23.67	42.08	1.12	1.99
1.00	-1.00	21.10	37.52	1.00	1.78	23.55	41.87	1.12	1.98	25.60	45.52	1.21	2.16
1.00	-0.90	23.17	41.20	1.10	1.95	25.63	45.57	1.21	2.16	27.70	49.24	1.31	2.33
1.00	-0.80	25.42	45.19	1.20	2.14	27.90	49.60	1.32	2.35	30.00	53.32	1.42	2.53
1.00	-0.70	27.88	49.57	1.32	2.35	30.40	54.05	1.44	2.56	32.54	57.85	1.54	2.74
1.00	-0.60	30.62	54.43	1.45	2.58	33.20	59.02	1.57	2.80	35.39	62.91	1.68	2.98
1.00	-0.50	33.71	59.92	1.60	2.84	36.36	64.65	1.72	3.06	38.62	68.66	1.83	3.25
0.90	-1.50	9.82	17.45	0.47	0.83	12.52	22.26	0.59	1.05	14.67	26.08	0.70	1.24
0.90	-1.40	11.60	20.62	0.55	0.98	14.17	25.19	0.67	1.19	16.25	28.89	0.77	1.37
0.90	-1.30	13.37	23.77	0.63	1.13	15.85	28.18	0.75	1.34	17.88	31.79	0.85	1.51
0.90	-1.20	15.16	26.96	0.72	1.28	17.59	31.27	0.83	1.48	19.60	34.84	0.93	1.65
0.90	-1.10	17.03	30.27	0.81	1.43	19.42	34.52	0.92	1.64	21.41	38.06	1.01	1.80
0.90	-1.00	18.99	33.75	0.90	1.60	21.37	37.98	1.01	1.80	23.36	41.53	1.11	1.97
0.90	-0.90	21.08	37.48	1.00	1.78	23.47	41.72	1.11	1.98	25.47	45.29	1.21	2.15
0.90	-0.80	23.36	41.52	1.11	1.97	25.76	45.80	1.22	2.17	27.80	49.41	1.32	2.34
0.90	-0.70	25.86	45.97	1.23	2.18	28.30	50.32	1.34	2.38	30.37	54.00	1.44	2.56

Table 5.3--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A*	Level 1[a] B Index B/A*	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A*	Level 2[b] B Index B/A*	Level 3[c] A	Level 3[c] B	Level 3[c] A Index A/A*	Level 3[c] B Index B/A*
0.90	-0.60	28.65	50.93	1.36	2.41	31.16	55.39	1.48	2.62	33.28	59.16	1.58	2.80
0.90	-0.50	31.82	56.57	1.51	2.68	34.40	61.16	1.63	2.90	36.60	65.07	1.73	3.08
0.80	-1.50	7.14	12.70	0.34	0.60	9.90	17.60	0.47	0.83	12.06	21.44	0.57	1.02
0.80	-1.40	9.06	16.11	0.43	0.76	11.63	20.68	0.55	0.98	13.69	24.34	0.65	1.15
0.80	-1.30	10.91	19.39	0.52	0.92	13.36	23.75	0.63	1.13	15.35	27.30	0.73	1.29
0.80	-1.20	12.75	22.67	0.60	1.07	15.13	26.90	0.72	1.27	17.09	30.38	0.81	1.44
0.80	-1.10	14.65	26.04	0.69	1.23	16.98	30.18	0.80	1.43	18.92	33.63	0.90	1.59
0.80	-1.00	16.63	29.57	0.79	1.40	18.94	33.67	0.90	1.60	20.87	37.11	0.99	1.76
0.80	-0.90	18.75	33.33	0.89	1.58	21.06	37.43	1.00	1.77	23.00	40.88	1.09	1.94
0.80	-0.80	21.05	37.41	1.00	1.77	23.37	41.55	1.11	1.97	25.33	45.04	1.20	2.13
0.80	-0.70	23.58	41.91	1.12	1.99	25.94	46.11	1.23	2.18	27.94	49.67	1.32	2.35
0.80	-0.60	26.41	46.96	1.25	2.23	28.83	51.26	1.37	2.43	30.89	54.91	1.46	2.60
0.80	-0.50	29.66	52.72	1.41	2.50	32.16	57.17	1.52	2.71	34.28	60.94	1.62	2.89
0.70	-1.50	4.13	7.34	0.20	0.35	6.97	12.39	0.33	0.59	9.16	16.29	0.43	0.77
0.70	-1.40	6.25	11.10	0.30	0.53	8.83	15.69	0.42	0.74	10.88	19.34	0.52	0.92
0.70	-1.30	8.20	14.58	0.39	0.69	10.63	18.89	0.50	0.90	12.59	22.39	0.60	1.06
0.70	-1.20	10.11	17.98	0.48	0.85	12.44	22.12	0.59	1.05	14.35	25.51	0.68	1.21
0.70	-1.10	12.05	21.42	0.57	1.01	14.31	25.44	0.68	1.21	16.19	28.78	0.77	1.36
0.70	-1.00	14.05	24.98	0.67	1.18	16.29	28.95	0.77	1.37	18.15	32.27	0.86	1.53
0.70	-0.90	16.18	28.77	0.77	1.36	18.41	32.73	0.87	1.55	20.28	36.05	0.96	1.71
0.70	-0.80	18.49	32.87	0.88	1.56	20.73	36.85	0.98	1.75	22.61	40.20	1.07	1.90
0.70	-0.70	21.04	37.40	1.00	1.77	23.31	41.44	1.10	1.96	25.23	44.85	1.20	2.13
0.70	-0.60	23.91	42.50	1.13	2.01	26.23	46.63	1.24	2.21	28.20	50.14	1.34	2.38
0.70	-0.50	27.21	48.36	1.29	2.29	29.61	52.64	1.40	2.49	31.65	56.27	1.50	2.67
0.60	-1.50	1.32	2.35	0.06	0.11	3.73	6.63	0.18	0.31	5.99	10.65	0.28	0.50
0.60	-1.40	3.30	5.86	0.16	0.28	5.80	10.32	0.27	0.49	7.86	13.97	0.37	0.66
0.60	-1.30	5.34	9.49	0.25	0.45	7.71	13.71	0.37	0.65	9.65	17.16	0.46	0.81
0.60	-1.20	7.32	13.01	0.35	0.62	9.58	17.04	0.45	0.81	11.45	20.35	0.54	0.96
0.60	-1.10	9.29	16.51	0.44	0.78	11.48	20.42	0.54	0.97	13.30	23.65	0.63	1.12
0.60	-1.00	11.31	20.11	0.54	0.95	13.47	23.94	0.64	1.13	15.26	27.14	0.72	1.29
0.60	-0.90	13.45	23.91	0.64	1.13	15.59	27.71	0.74	1.31	17.38	30.90	0.82	1.46
0.60	-0.80	15.76	28.01	0.75	1.33	17.90	31.82	0.85	1.51	19.70	35.03	0.93	1.66
0.60	-0.70	18.30	32.54	0.87	1.54	20.47	36.40	0.97	1.72	22.31	39.66	1.06	1.88
0.60	-0.60	21.18	37.65	1.00	1.78	23.40	41.60	1.11	1.97	25.28	44.95	1.20	2.13
0.60	-0.50	24.51	43.57	1.16	2.06	26.80	47.65	1.27	2.26	28.76	51.13	1.36	2.42
0.50	-1.50	0.21	0.38	0.01	0.02	0.70	1.24	0.03	0.06	2.10	3.73	0.10	0.18
0.50	-1.40	0.87	1.54	0.04	0.07	2.35	4.18	0.11	0.20	4.22	7.51	0.20	0.36

Table 5.3--Continued

		Level 1[a]				Level 2[b]				Level 3[c]			
e_s	e_d	A	B	A Index A/A∘	B Index B/A∘	A	B	A Index A/A∘	B Index B/A∘	A	B	A Index A/A∘	B Index B/A∘
0.50	-1.30	2.28	4.06	0.11	0.19	4.30	7.65	0.20	0.36	6.16	10.95	0.29	0.52
0.50	-1.20	4.12	7.33	0.20	0.35	6.23	11.08	0.30	0.52	8.02	14.26	0.38	0.68
0.50	-1.10	6.08	10.80	0.29	0.51	8.16	14.50	0.39	0.69	9.90	17.60	0.47	0.83
0.50	-1.00	8.10	14.39	0.38	0.68	10.15	18.04	0.48	0.85	11.86	21.09	0.56	1.00
0.50	-0.90	10.22	18.17	0.48	0.86	12.25	21.78	0.58	1.03	13.96	24.81	0.66	1.18
0.50	-0.80	12.51	22.24	0.59	1.05	14.54	25.84	0.69	1.22	16.25	28.89	0.77	1.37
0.50	-0.70	15.03	26.72	0.71	1.27	17.08	30.36	0.81	1.44	18.81	33.45	0.89	1.58
0.50	-0.60	17.88	31.79	0.85	1.51	19.98	35.51	0.95	1.68	21.75	38.67	1.03	1.83
0.50	-0.50	21.20	37.70	1.00	1.79	23.37	41.55	1.11	1.97	25.22	44.83	1.19	2.12

[a]The numbers in Level 1 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=2.0, δ_1=-.3, δ_2=-.4, θ_1=.5, θ_2=.5, P_x=$32.0, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=1.0, e_d=-1 and P_x=$32.0.

[b]The numbers in Level 2 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=2.0, δ_1=-.3, δ_2=-.4, θ_1=.5, θ_2=.5, P_x=$40.0, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=1.0, e_d=-1 and P_x=$32.0.

[c]The numbers in Level 3 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=2.0, δ_1=-.3, δ_2=-.4, θ_1=.5, θ_2=.5, P_x=$48.0, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=1.0, e_d=-1 and P_x=$32.0.

of the product are accompanied by increases in the levels of generic and brand advertising. This finding can be explained through the optimal static advertising rule $v=|e_d|$ (Dorfman and Steiner, 1954),

$$v=|e_d|,$$

$$v=Q_a\ P$$

$$(\partial Q/\partial a)\ P = |e_d|,$$

$$(\partial Q/\partial a)(Q/Q)(a/a)(P) = |e_d|,$$

$$(e_a)(Q\ (P/a)) = |e_d|,$$

$$(a\ /\ (P\ Q)) = (e_a/|e_d|),$$

$$a = (e_a/|e_d|)\ (P)\ (Q),$$

where v is the marginal value product; $Q_a=\partial Q/\partial a$; Q is the demand for a product X; a is the advertising expenditure; e_d is the price elasticity of demand; P is the product price; and $e_a = (\partial Q/\partial a)(a/Q)$ is the advertising elasticity.

As can be seen from this derivation, if the level of advertising increases, the product price also increases to maintain the equality of the advertising rule; thus, there is a direct relationship between the level of advertising and the price of the product (ceteris paribus).

Table 5.3 also presents the combined effects of changes in P_X, e_s and e_d on the generic and brand advertising expenditures. As e_d varies from -1.50 (elastic) to -0.5 (inelastic), holding e_s=1.0 and P_X=\$32.0, the A-index and the B-index will adjust from low values of 0.58 and 1.03 to high values of 1.60 and 2.84. If P_X increases to \$40.0, the indices for A and B vary from low values of 0.70 and 1.25 to high values of 1.72 and 3.06. If P_X is increased even more to \$48.0, the A-index and the B-index will vary from low values of 0.81 and 1.43 to

high values of 1.83 and 3.25. Some of these results are also illustrated in Figure 5.9, where P_x has been simulated at the levels of \$32.0 and \$48.0. The higher the level of P_x and the more inelastic the price elasticity of demand, the larger the index for both A and B.

Similarly, as e_s changes from 0.50 (inelastic) to 1.50 (elastic), holding e_d=-1.0 and P_x=\$32.0, the indices for A and B adjust from minimum values of 0.38 and 0.68 to maximum values of 1.41 and 2.50. If P_x is increased to \$40.0, the A-index and the B-index change from minimum values of 0.48 and 1.53 to maximum values of 0.85 and 2.72, respectively. If P_x is increased even more to \$48.0, the indices for A and B show minimum values of 0.56 and 1.00 and maximum values of 1.64 and 2.91. As can be seen, the larger the relative levels of generic and brand advertising expenditures (indices), the higher the level of P_x, and the larger (more elastic) the e_s. These results are also consistent with the previous findings of the effects of e_s on generic and brand advertising expenditures. Figure 5.10 also illustrates some of these results where P_x has been simulated at the levels of \$32.0 and \$48.0.

Effects of δ_1 and δ_2 on Generic and Brand Advertising

Table 5.4 presents the effects of the generic advertising parameter (δ_1) and the brand advertising parameter (δ_2) on the optimal expenditure levels of generic and brand advertising. The values of the parameters δ_1 and δ_2 represent the combined contribution of all those product attributes whose presence is necessary for successfully promoting a product through generic and/or brand promotions. The advertising model has been constructed such that any change in either

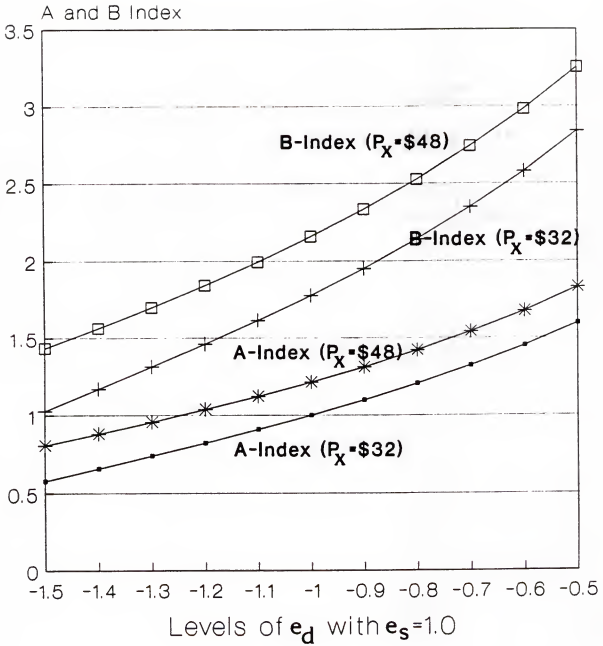

Figure 5.9 Advertising Adjustments to Product Price and Price Elasticity of Demand

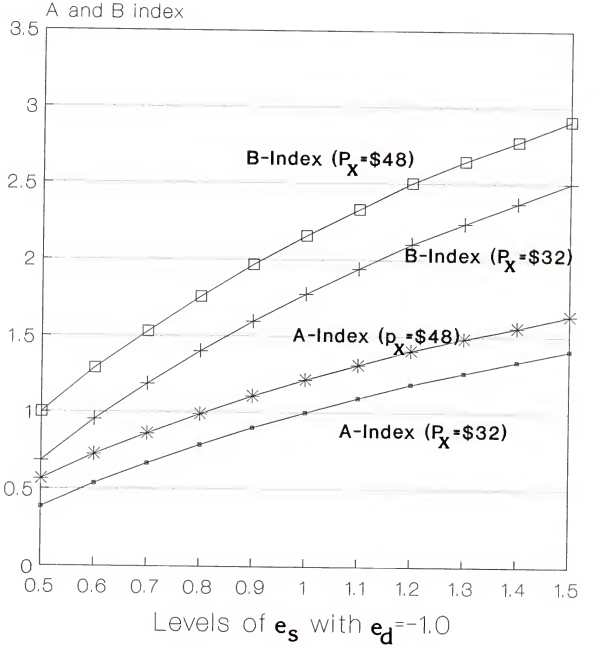

Figure 5.10 Advertising Adjustments to Product Price and Price Elasticity of Supply

Table 5.4 Optimal Levels of Generic and Brand Advertising Under Different Levels of Advertising Perception

δ_1	δ_2	A	B	A^e Index A/A°	B Index B/A°	share Index A/A+B
-0.70	-0.40	29.99	9.79	1.36	0.44	0.75
-0.65	-0.40	31.03	11.75	1.41	0.53	0.73
-0.60	-0.40	31.91	14.18	1.45	0.64	0.69
-0.55	-0.40	32.53	17.21	1.48	0.78	0.65
-0.50	-0.40	32.77	20.97	1.49	0.95	0.61
-0.45	-0.40	32.47	25.65	1.47	1.16	0.56
-0.40	-0.40	31.43	31.43	1.43	1.43	0.50
-0.35	-0.40	29.44	38.46	1.34	1.74	0.43
-0.30	-0.40	26.34	46.82	1.19	2.12	0.36
-0.25	-0.40	22.04	56.43	1.00	2.56	0.28
-0.70	-0.45	26.98	11.15	1.22	0.51	0.71
-0.65	-0.45	27.60	13.23	1.25	0.60	0.68
-0.60	-0.45	28.02	15.76	1.27	0.71	0.64
-0.55	-0.45	28.14	18.84	1.28	0.85	0.60
-0.50	-0.45	27.87	22.58	1.26	1.02	0.55
-0.45	-0.45	27.09	27.09	1.23	1.23	0.50
-0.40	-0.45	25.65	32.47	1.16	1.47	0.44
-0.35	-0.45	23.46	38.79	1.06	1.76	0.38
-0.30	-0.45	20.45	46.01	0.93	2.09	0.31
-0.25	-0.45	16.65	53.96	0.76	2.45	0.24
-0.70	-0.50	24.15	12.32	1.10	0.56	0.66
-0.65	-0.50	24.43	14.46	1.11	0.66	0.63
-0.60	-0.50	24.49	17.01	1.11	0.77	0.59
-0.55	-0.50	24.25	20.04	1.10	0.91	0.55
-0.50	-0.50	23.64	23.64	1.07	1.07	0.50
-0.45	-0.50	22.58	27.87	1.02	1.26	0.45
-0.40	-0.50	20.97	32.77	0.95	1.49	0.39
-0.35	-0.50	18.79	38.34	0.85	1.74	0.33
-0.30	-0.50	16.02	44.50	0.73	2.02	0.26
-0.25	-0.50	12.76	51.03	0.58	2.32	0.20
-0.70	-0.55	21.54	13.30	0.98	0.60	0.62
-0.65	-0.55	21.55	15.43	0.98	0.70	0.58
-0.60	-0.55	21.35	17.94	0.97	0.81	0.54
-0.55	-0.55	20.86	20.86	0.95	0.95	0.50
-0.50	-0.55	20.04	24.25	0.91	1.10	0.45
-0.45	-0.55	18.84	28.14	0.85	1.28	0.40
-0.40	-0.55	17.21	32.53	0.78	1.48	0.35
-0.35	-0.55	15.14	37.39	0.69	1.70	0.29
-0.30	-0.55	12.67	42.59	0.57	1.93	0.23
-0.25	-0.55	9.91	47.96	0.45	2.18	0.17
-0.70	-0.60	19.15	14.07	0.87	0.64	0.58
-0.65	-0.60	18.97	16.16	0.86	0.73	0.54

Table 5.4--Continued

[a] δ_1	[b] δ_2	[c] A	[d] B	[e] A Index A/A∘	B Index B/A∘	share Index A/A+B
-0.60	-0.60	18.58	18.58	0.84	0.84	0.50
-0.55	-0.60	17.94	21.35	0.81	0.97	0.46
-0.50	-0.60	17.01	24.49	0.77	1.11	0.41
-0.45	-0.60	15.76	28.02	0.72	1.27	0.36
-0.40	-0.60	14.18	31.91	0.64	1.45	0.31
-0.35	-0.60	12.29	36.11	0.56	1.64	0.25
-0.30	-0.60	10.13	40.50	0.46	1.84	0.20
-0.25	-0.60	7.80	44.92	0.35	2.04	0.15
-0.70	-0.65	17.00	14.66	0.77	0.66	0.54
-0.65	-0.65	16.68	16.68	0.76	0.76	0.50
-0.60	-0.65	16.16	18.97	0.73	0.86	0.46
-0.55	-0.65	15.43	21.55	0.70	0.98	0.42
-0.50	-0.65	14.46	24.43	0.66	1.11	0.37
-0.45	-0.65	13.23	27.60	0.60	1.25	0.32
-0.40	-0.65	11.75	31.03	0.53	1.41	0.27
-0.35	-0.65	10.05	34.65	0.46	1.57	0.22
-0.30	-0.65	8.17	38.36	0.37	1.74	0.18
-0.25	-0.65	6.22	42.02	0.28	1.91	0.13
-0.70	-0.70	15.07	15.07	0.68	0.68	0.50
-0.65	-0.70	14.66	17.00	0.66	0.77	0.46
-0.60	-0.70	14.07	19.15	0.64	0.87	0.42
-0.55	-0.70	13.30	21.54	0.60	0.98	0.38
-0.50	-0.70	12.32	24.15	0.56	1.10	0.34
-0.45	-0.70	11.15	26.98	0.51	1.22	0.29
-0.40	-0.70	9.79	29.99	0.44	1.36	0.25
-0.35	-0.70	8.28	33.11	0.38	1.50	0.20
-0.30	-0.70	6.66	36.25	0.30	1.64	0.16
-0.25	-0.70	5.01	39.29	0.23	1.78	0.11

Note: The numbers in this table have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, e_s=.67, e_d=-.5, δ_0=2.0, θ_1=.5, θ_2=.5, P_x=$32.0, P_a=$1.0 and P_b=$1.0

[a] δ_1 is the generic advertising parameter

[b] δ_2 is the brand advertising parameter

[c] A is the level of generic advertising expenditures

[d] B is the level of brand advertising expenditures

[e] A∘ is the level of generic advertising expenditures used as the reference base point at δ_1=-.25 and δ_2=-.40

δ_1 and/or δ_2 will change the relative optimal expenditure levels of generic and brand advertising; therefore the effects of changes in δ_1 and δ_2 on the optimal levels of generic and brand advertising have to be evaluated through the joint use of the A-index and the B-index, as in previous sections. The base point of reference is set at δ_1=-0.25, δ_2=-0.40, e_s=0.67 and e_d=-0.50. The optimal advertising expenditures at the standard base are A=22.04 and B=56.43. At this point the A-index is 22.04/22.04=1.0 and the B-index is 56.43/22.04=2.56.

Another standard measure, the share index, will also be utilized to measure the effects of changes in the generic and brand parameter on the advertising model. It is calculated as the proportion of generic advertising to the total advertising level, (A/(A+B)). This share index can evaluate the adjustments of the relative expenditure levels of generic and brand advertising when the direct effect of generic (δ_1) and/or brand (δ_2) advertising changes. It is a more general index than the A-index and the B-index in the sense that any two situations can be compared since there is no special base of reference (in contrast, the A-index and the B-index have to be evaluated jointly and always relate to one specific point of reference). But, it is also limited to comparing only those cases where at least δ_1 and δ_2 are the adjusting advertising factors, or the index will not show any adjustment because of the assumptions made when developing the advertising model.

Starting at the standard base of reference, a 20 percent increase in $|\delta_1|$, from -0.25 to -0.30, increases the A-index by 19 percent and decreases the B-index by 17 percent. A 40 percent increase in $|\delta_1|$, from -0.25 to -0.35, increases the A-index by 34 percent and decreases

the B-index by 32 percent. A 100 percent increase in $|\delta_1|$, from -0.25 to -0.50, increases the A-index by 49 percent and decreases the B-index by 63 percent. These results indicate that as the level of the generic advertising parameter increases relative to the level of the brand advertising parameter, the values of generic and brand advertising will adjust to show an increase of the relative level of generic advertising because this type of promotion has become more productive than the brand type.

Using the same standard base, a 12.50 percent increase in $|\delta_2|$, from -0.40 to -0.45, decreases the A-index by 24 percent and also decreases the B-index, but by only 4 percent. A 50 percent increase in $|\delta_2|$, from -0.40 to -0.60, decreases the A-index by 65 percent and decreases the B-index by 20 percent. As can be seen from these results, when the brand advertising parameter is increasing relative to the generic advertising parameter, the relative levels of generic and brand advertising expenditures adjust to show a relative increase in the use of brand advertising. In particular, note that even though both indices (A-index and B-index) are decreasing, the generic index is decreasing faster; thus, relatively more brand advertising is being utilized in the market.

Figure 5.11 illustrates the adjustment process of the relative levels of generic and brand advertising when the level of the generic advertising parameter increases relative to the brand parameter. As $|\delta_1|$ is increasing from -0.25 to -0.70, holding δ_2 at -.40, the indexed levels of A increase from 1.0 to 1.36 and the indexed levels of B decrease from 2.56 to 0.44. Note also that the indexed levels of both

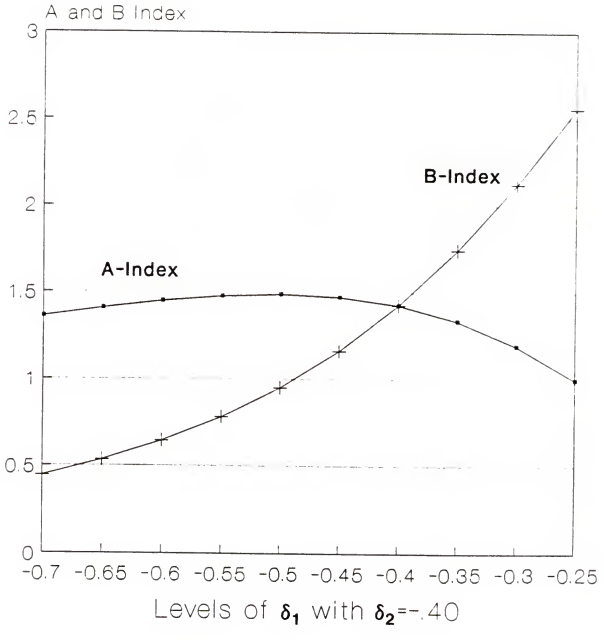

Figure 5.11 Advertising Adjustments to the Generic Parameter with the Brand Parameter at -0.4

A and B are the same when their respective advertising parameters have the same value (δ_1=δ_2=-.4); that is, both advertising parameters are equally efficient (Table 5.4).

Figure 5.12 shows the case where $|\delta_1|$ increases in the same range as in Figure 5.11 but the fixed level of $|\delta_2|$ is now higher at -0.70. The indexed level for A increases from a low of 0.23 to a high of 0.68, and the indexed level for B decreases from a high of 1.78 to a low of 0.68 (Table 5.4). Note that as the parameter δ_1 becomes more efficient (its absolute value is larger), the A-index increases relative to the B-index; that is, more generic advertising compared to brand advertising should be utilized by the market.

Another example is presented in Figure 5.13. It illustrates a situation where $|\delta_2|$ increases from -0.40 to -0.70, holding δ_1 at -0.25. The indexed levels of A adjust from 1.0 to 0.23 and the indexed levels of B from 2.56 to 1.78 (Table 5.4). Even though the B-index for brand advertising is decreasing (as $|\delta_2|$ increases), its decreasing rate is slower than the decreasing rate of the A-index for generic promotion; thus, the actual relative levels of brand advertising increase with respect to the levels of generic advertising.

The share index is the other standard measure used here to evaluate the effects of changes in δ_1 and δ_2 on the advertising model. The share index takes into account the necessary adjustments in A and B as the advertising parameters vary. This index is quite useful in the context of studying the advertising effects of any two situations since no base point of reference is used. A 20 percent increase in $|\delta_1|$, from -0.25 to -0.30, holding δ_2=-.40, increases the share index from

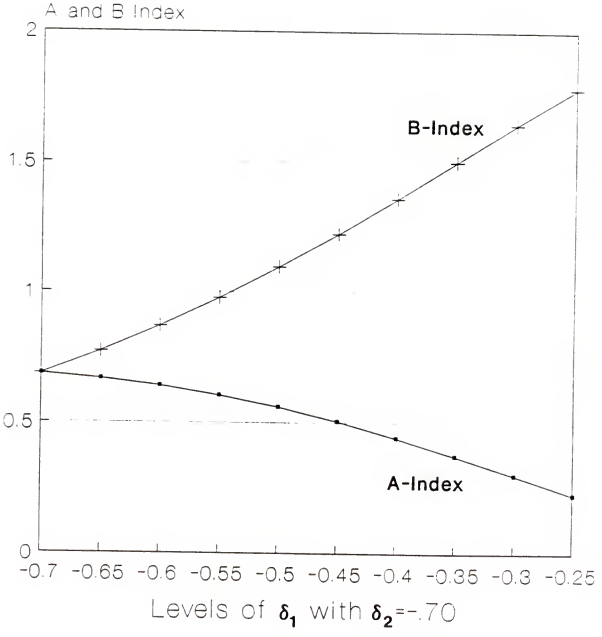

Figure 5.12 Advertising Adjustments to the Generic Parameter with the Brand Parameter at -0.7

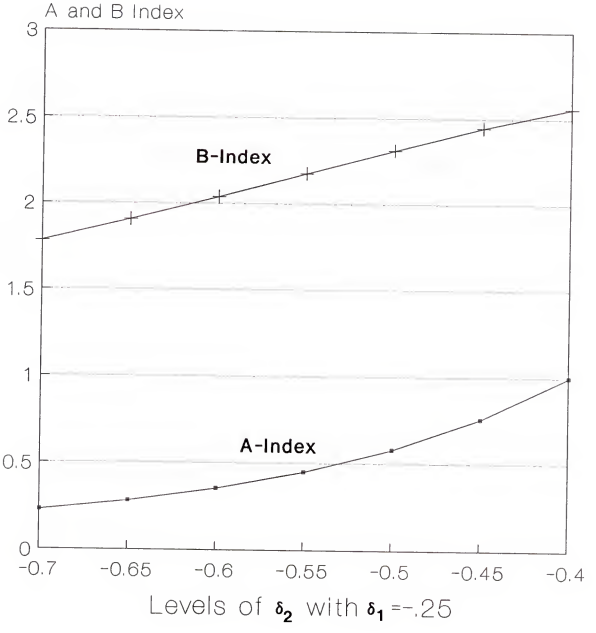

Figure 5.13 Advertising Adjustments to the Brand Parameter with the Generic Parameter at -0.25

0.28 to 0.36. A 100 percent increase in $|\delta_1|$, from -0.25 to -0.50, holding δ_2=-.40, increases the share index from 0.28 to 0.61 (Table 5.4). The share index shows that, as the generic parameter is relatively more efficient than the brand parameter, the relative optimal level of A with respect to B should increase. This result is consistent with the previous evaluation of the advertising model in terms of the A-index and the B-index.

Figure 5.14 illustrates the share index as it adjusts to different levels of δ_1, holding δ_2 at -.40. As the parameter $|\delta_1|$ increases from -.25 to -.70, the share index increases steadily from a low of 0.28 to a high of 0.75. Figure 5.15 presents the changes in δ_1 from -0.25 to -0.70 as the brand advertising parameter is held fixed at four different levels: -0.40, -0.50, -0.60 and -0.70. The share index shows all the adjustments needed in A and B relative to changes of δ_1 and δ_2. At any of the fixed levels of δ_2, the share index increases as $|\delta_1|$ increases relative to $|\delta_2|$. That is, the optimal levels of generic advertising compared to brand advertising increase as the ratio of the generic and brand parameter also increases.

Changes in δ_2 present a similar pattern. A 25 percent increase in $|\delta_2|$, from -0.40 to -0.50, holding δ_1=-.25, decreases the share index from 0.28 to 0.20. A 75 percent increase in $|\delta_2|$, from -0.40 to -0.70, holding δ_1=-.25, decreases the share index from 0.28 to 0.11. The share index calculated as the proportion of generic promotion over the total amount of advertising (generic and brand) shows that as $|\delta_2|$ increases (holding δ_1 constant), the relative optimal advertising levels of brand advertising with respect to generic should increase. Figure

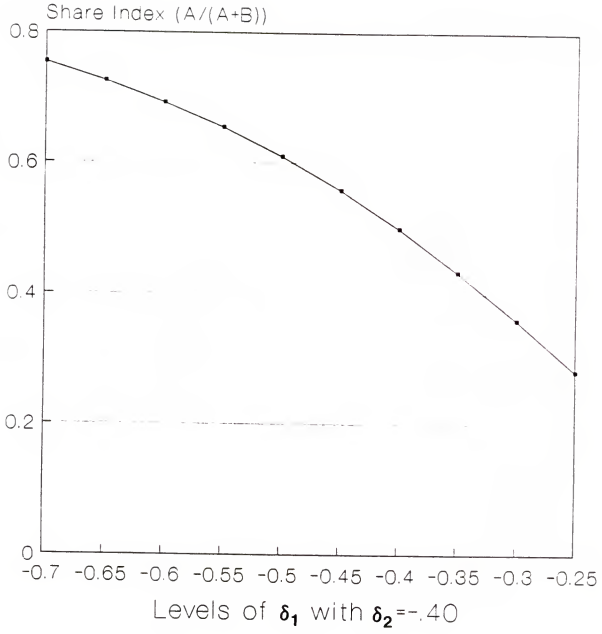

Figure 5.14 Advertising Adjustments to the Generic Parameter with the Brand Parameter at -0.4, Measured by the Share Index

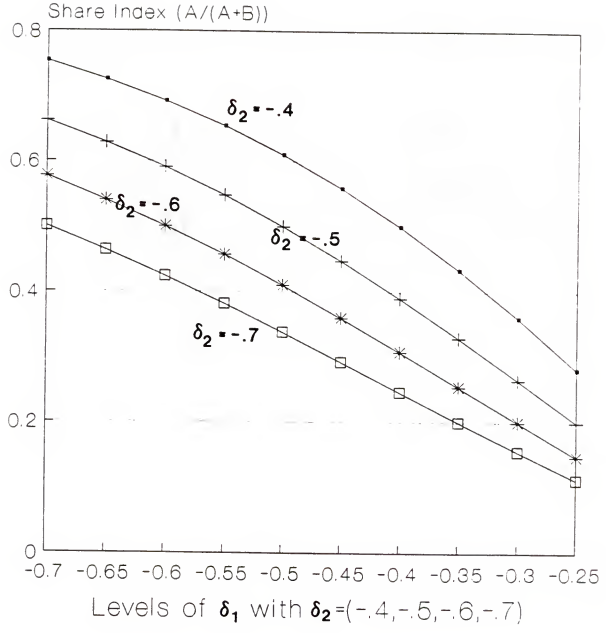

Figure 5.15 Advertising Adjustments to the Generic Parameter with the Brand Parameter at -0.4, -0.5, -0.6 and -0.7, Measured by the Share Index

5.16 illustrates the adjustments in the share index as $|\delta_2|$ increases from -0.40 to -0.70, holding δ_1=-0.25. The share index decreases continuously from 0.28 to 0.11 (Table 5.4). Figure 5.17 presents results similar to those of Figure 5.15 but with the roles of δ_1 and δ_2 reversed. The levels of δ_2 change from -.40 to -.70 and the level of δ_1 is held fixed at -0.40, -0.50, -0.60, and -0.70. At any of the fixed levels of δ_1 the share index decreases as $|\delta_2|$ increases relative to $|\delta_1|$; that is, brand advertising becomes more efficient compared to generic advertising in the delivery of the product information to the consumer.

Because the share index does not depend on a base point of reference, it is also possible to directly compare cases where both δ_1 and δ_2 change. For example, a 25 percent increase in $|\delta_2|$, from -0.40 to -0.50, and a 40 percent increase in $|\delta_1|$, from -0.25 to -0.35, will increase the share index from 0.28 to 0.33. On the other hand, a 37.5 percent increase in $|\delta_2|$, from -0.40 to -0.55, and a 20 percent increase in $|\delta_1|$, from -0.25 to -0.30, will decrease the share index from 0.28 to 0.23. This comparison implies that a producer marketing a product with stronger product attributes favorable for generic promotion than for brand advertising should use a relatively larger proportion of generic compared to brand advertising expenditures.

Concluding Comments

This chapter has presented a hypothetical example of simulating the effects of changes in product attributes and market structure on the optimal levels of generic and brand advertising expenditures in the marketing of a product.

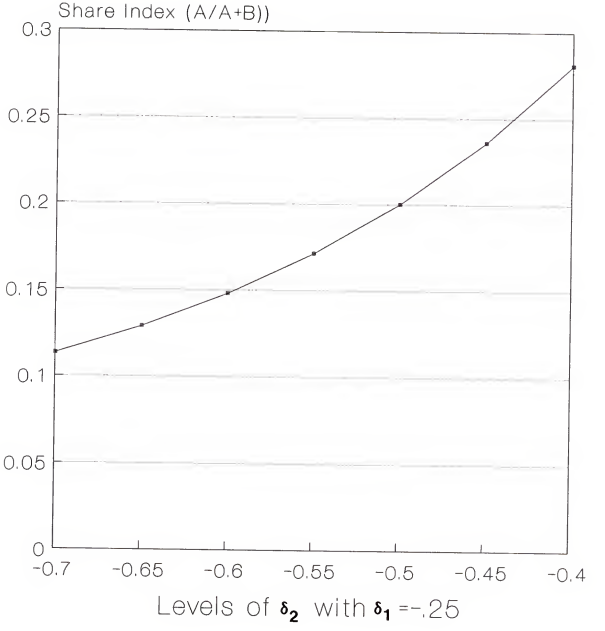

Figure 5.16 Advertising Adjustments to the Brand Parameter with the Generic Parameter at -0.25, Measured by the Share Index

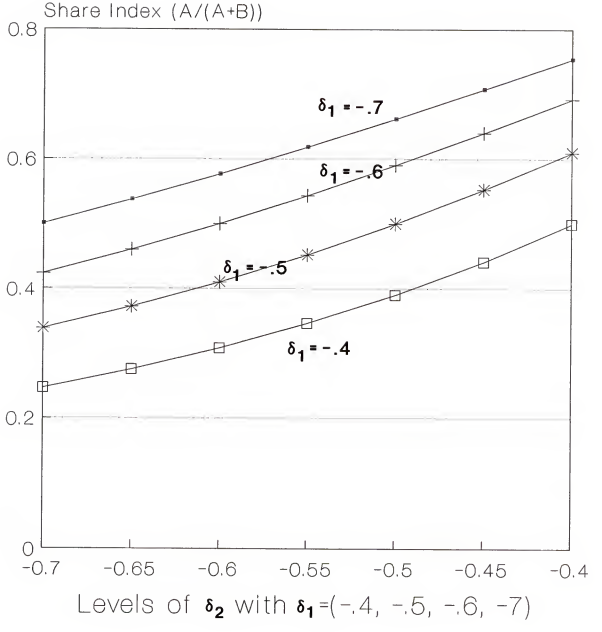

Figure 5.17 Advertising Adjustments to the Brand Parameter with the Generic Parameter at -0.4, -0.5, -0.6, and -0.7, Measured by the Share Index

The effects of the market structure on advertising levels in a market are simulated through the adjustments in the price elasticity of supply and price elasticity of demand. It is found that the price elasticity of demand (e_d) is inversely related to the expenditure levels of generic and brand advertising. The more price elastic the demand, the smaller the relative levels of generic (A) and brand (B) advertising. This inverse relationship between e_d and A (or B) is explained using the fundamental theorem of advertising defined by Dorfman and Steiner (1954), where it is shown that profits for an industry are maximized when advertising intensity (or advertising-sales ratio) is equal to the ratio of advertising elasticity to price elasticity of demand. Therefore, the larger the $|e_d|$ the smaller the advertising intensity.

The price elasticity of supply, on the other hand, is found to be directly related to the expenditure levels of generic and brand advertising. The more price elastic the supply, the larger the relative expenditures of A (or B). The consumer accepts smaller levels of advertising when e_s is relatively inelastic because the use of advertising (by the producer) to promote a product is perceived by the consumer mainly as an effort to increase the price of a product.

The effects of the product attributes on the optimal advertising expenditure levels of A and B are evaluated through the parameters of the advertising function. The values of the parameters δ_1 and δ_2 represent the combined contribution of all those product attributes whose presence are necessary for successfully promoting a product through generic and/or brand promotions. A general implication

resulting from the evaluation of these two parameters is that a producer marketing a product with strong product attributes more favorable for generic (brand) promotion than for brand (generic) advertising should use a relatively larger proportion of generic (brand) compared to brand (generic) advertising expenditures.

The parameter δ_0 (of the advertising function), which represents the level of product information, was also simulated at three different levels: low (26 percent), medium (50 percent) and high (73 percent). An inverse relationship is found between the advertising expenditure levels and the level of product knowledge. The higher the level of the product information, the smaller the level of advertising required in the market.

Finally, target product prices and advertising expenditures were simulated. It was determined that the larger the level of advertising, the greater the product price required in the market. Using the optimal advertising rule (Dorfman and Steiner, 1954), an augment in the level of advertising will also increase the price of the product to maintain the equality of the optimal advertising condition.

CHAPTER VI

SIMULATION OF ADVERTISING ON AGRICULTURAL PRODUCTS

Introduction

This chapter uses the advertising model developed in this study to simulate the advertising effects on different agricultural products. The same advertising scenario used in the previous general simulation, where both generic and brand advertising expenditure levels are obtained at the point $S_a=S_b=0$, will be utilized to simulate the advertising effects on beef, milk and potatoes. These three agricultural products were selected because they all use generic advertising to promote their products under national promotion acts and are assumed to be generally effective in their effort. This simulation has a dual purpose. The first purpose is to evaluate the relative effects of different levels of product knowledge, ratios of generic and brand advertising, and supply and demand elasticities on the levels of generic and brand advertising for a particular agricultural product. The second purpose is to exercise a similar evaluation across agricultural products.

Estimates of the Advertising Model Parameters

It is assumed at this point that producers and consumers are the direct actors in the exchange of the product and that this activity is realized at the consumer (retail) level. To simulate and evaluate the effects of the advertising factors on the levels of generic and brand advertising expenditures in agricultural products, values for the

parameters of the advertising model need to be obtained or estimated for each agricultural product.

Parameters α_0, α_1

The parameter α_0 will be evaluated at the value used in the general simulation and is assumed to be the same for all agricultural products; i.e., α_0=70.

The parameter α_1 will use as a proxy the price elasticity of demand of the agricultural product under consideration. Elasticities depend on the data used in the estimation (time period, cross section data, time series, or a combination of both cross section and time series), the functional forms assumed for the equations, and the specific econometric techniques utilized in the estimation procedure. In the following analysis, two different sources of estimated price elasticities will be used in the simulation. This approach will allow the evaluation of advertising on agricultural products under a range of elasticity values; that is, a sensitivity analysis of the advertising model to the price elasticity of demand.

Table 6.1 presents the estimates of the price elasticities of demand and their sources. George and King (1971) provide one estimate of price elasticity of demand for all three agricultural products at both the farm level and the retail level. Huang (1985) presents the other price elasticity estimate at the retail level. In the case of the price elasticity of demand, even though the product exchange is assumed at the retail level, the price elasticity at farm level will be used also because it was found that one estimate at the farm level (from George and King, 1971) was actually greater than some retail

Table 6.1 Estimates of Demand Elasticities for Beef, Milk and Potatoes

Product	Author	Elasticities	
		Farm	Retail
Beef	George and king[a]	-0.4164	-0.6438
	Huang[b]		-0.6166
Milk	George and King	-0.3239	-0.3455
	Huang		-0.2588
Potatoes	George and King	-0.1495	-0.3085
	Huang		-0.3688

[a]George and King (1971)

[b]Huang (1985)

price elasticity estimates (from Huang, 1985). Theoretically, the price elasticity at the retail level is expected to be greater than at the farm level. This apparent inconsistency between the estimated values arrived at by these two authors for price elasticity of demand at the farm and at the retail level occurs because they use different time spans, different econometric techniques and different functional forms for the demand equations. Thus, both sets of elasticity estimates are significant under their own assumptions. Instead of choosing the estimates of one author only, this study will utilize a range of the elasticity estimates (from both authors) lying between the minimum and maximum values of the retail and/or the farm level. Also, since the advertising model will be evaluated in terms of its sensitivity to the price elasticity of demand, the previously defined range of elasticity values will serve this purpose. The demand price elasticity for beef, milk and potatoes will range from -0.4164 to -0.6438, from -0.2588 to -0.3455, and from -0.1495 to -0.3688, respectively. The negative sign of the estimates shows that changes in product quantity (demanded) and changes in product price are inversely related.

Parameters β_0 and β_1

The parameter β_0 will be also defined at the value used in the general simulation and it is assumed the same for all agricultural products; i.e., β_0=0.5.

The parameter β_1 can be calculated if there are estimates for the supply elasticity ($\beta_1 = (1/(e_s - 1))$. As in the case of the price elasticity of demand, the estimates of the price elasticity of supply depend on the data used in the estimation, the estimating model, the

functional forms utilized for the estimating equations, the econometric techniques used to estimate, and any other assumptions maintained in solving the estimation problem. In the particular case of supply studies, judging the quality of most empirical estimates of supply elasticities is less robust and suspect. One of the purposes of this chapter is to show the effects of the price elasticity of supply on the levels of advertising for several agricultural products. Instead of using any single estimate, a range of estimated values of supply elasticity from two different sources will be utilized for this simulation, and the advertising model will be evaluated for its sensitivity to the supply elasticity parameter later on.

Table 6.2 presents the supply elasticities estimates and their sources for the three agricultural products. The e_s estimates have been obtained from Askari and Cummings (1977), Ospina and Shumway (1979), Howard and Shumway (1988), Taylor and Shonkwiler (1985), and Tweeten (1979). Also, all elasticities estimates have been calculated at the producer level. In general, the value of the price elasticity of supply tends to be highest for products that comprise a small part of farm production. These products can generally be produced under a wide range of resource conditions, have alternatives which are readily substituted in production, and usually have a short production period.

The estimates of supply elasticity for beef, milk and potatoes range from 0.14 to 0.50, from 0.03 to 0.25 and from 0.15 to 0.80, respectively. The positive estimates of the supply elasticity show the

Table 6.2 Estimates of Supply Elasticities for Beef, Milk and Potatoes

Product	Author	Elasticity
Beef	Ospina and Shumway[a]	0.14
	Tweeten[b]	0.50
Milk	Askari and Cummings[c]	0.03
	Howard and Shumway[d]	0.25
Potatoes	Taylor and Shonkwiler[e]	0.15
	Tweeten	0.80

[a]Ospina and Shumway (1979)

[b]Tweeten (1979)

[c]Askari and Cummings (1977)

[d]Howard and Shumway (forthcoming in 1988)

[e]Taylor and Shonkwiler (1985)

direct relationship between changes in product price and changes in product quantity (supplied).

Parameters δ_0, δ_1 and δ_2

The parameter δ_0, which represents the level of product knowledge, will be evaluated at two different levels. A medium level, δ_0=0, representing 50 percent of product information, and a high level, δ_0=-1.0, representing 73 percent of product information.

The level of the parameter δ_1, which represents the effectiveness of generic advertising in informing or persuading a consumer to buy a product, will be obtained (for each agricultural product) using the concept of "wholesome nutritive food" defined by Williams (1977). It is assumed that the nutritive characteristics of the product will be the main factor deciding the level of δ_1 for an agricultural product. Other factors, such as identification of a product and product homogeneity, are considered to have a similar but lesser impact on the level of δ_1 and are therefore assumed to be less important in helping differentiate the level of δ_1 for these agricultural products.

A wholesome nutritive food is one that, besides furnishing enough calories (energy) on a daily basis, will also supply significant amounts of the growth and maintenance elements (chemicals). The phrase "significant amounts" means that without certain levels of these essential elements the human body is not able to function properly. These required growth and maintenance chemicals are divided into four groups: amino acids, major minerals, trace minerals and vitamins.

The amino acids include: isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. These essential chemicals are white crystalline substances usually obtained from proteins. Unfortunately, these amino acids cannot be made within the human body but must be supplied through food items.

Both major and trace minerals are usually present in food in the form of salts and their definition as major or trace is based on the daily indispensable amount (large or tiny) needed by the human living cells to function properly. The major minerals are: calcium, chloride, potassium, magnesium, sodium and phosphate. The trace elements include: cobalt, chromium, copper, fluorine, iron, iodine, manganese, molybdenum, selenium and zinc.

Vitamins are a heterogeneous group of organic (carbon-containing) substances and they are classified as: vitamin A, biotin, vitamin B_6, vitamin B_{12}, vitamin C, vitamin D, vitamin E, folic acid, vitamin K, niacinamide, pantothenic acid, riboflavin and thiamin. These thirteen vitamins are known to play an important role in the development and maintenance of all cells and body organs.

Williams (1977) used the concept of wholesome nutritive food to compare different food products in terms of nutritive quality. He postulated that all good, wholesome foods should supply calories balanced by significant amounts of the growth and maintenance chemicals. He then produced a series of charts for about 40 different food products showing the quantities of each food necessary to satisfy the requirements of 2500 calories (a recommended average daily requirement for a male weighing 50 kgs and between 20 to 50 years of

age). Each product chart also illustrated the supplied levels of growth and maintenance chemicals provided by the consumption of this food quantity compared to the required daily amounts needed of these essential chemicals. In other words, each diagram presents a picture of the trophic value of a food; that is, its ability to supply the essentials above and beyond energy or calories. It shows what kinds and amounts of growth and maintenance chemicals a person could obtain from a particular food if he were to satisfy an average day's energy requirement by eating that food alone.

Even though it is recognized that there is hardly a single person who eats only one kind of food to satisfy diet requirements, this concept of wholesome nutritive food provides a useful standard of comparison among different agricultural products, based on nutritional characteristics. It furnishes producers and consumers some of the potential information for decision making. Producers can use this information to set up certain advertising strategies (how, how much, what, who) to promote their product generically. Consumers will be more aware of the nutritional properties of the different agricultural products and then can adjust accordingly their own perception (level of δ_1) of the information provided by the generic advertisements of an agricultural product. Furthermore, for the purpose of this dissertation, the concept of wholesome nutritive food provides an estimate of the value of the product price to be used in the simulation of advertising in agricultural products since the amount of the product needed for the 2500 calories requirement has been determined (see the

following section about the estimates for the prices of the agricultural products).

Table 6.3 presents how well (in percentage terms) the three agricultural products are able to satisfy the recommended requirements of growth and maintenance chemicals while at the same time providing the necessary 2500 calories. Each of the essential chemical groups is given the same percentage (25 percent) to fill in the overall requirement (100 percent). A full 25 percent is given to any group if all chemicals in the class completely satisfy their diet requirements; otherwise less than the full 25 percent is awarded.

Under this criteria, if a chemical in any class fully satisfies the daily requirement, it is given a 1.00 point. If it is less than a full requirement but more than half, it is given a 0.50 point. If it is less than half of the daily requirement but still present at some level, a 0.25 point is assigned. The complete absence of the chemical is given a 0.0 point. For example, in the major minerals group for the product potatoes, three chemicals (potassium, magnesium and phosphate) provide the full dietary requirement and the remaining three chemicals (calcium, chloride and sodium) in the class are absent, which results in the following calculation: 1.0 (points) for potassium, 1.0 for magnesium, 1.0 for phosphate, 0.0 for calcium, 0.0 for chloride, and 0.0 for sodium; for a total of 3.0 points. Since this class can have a maximum of 6 points (all 6 chemicals fully satisfying their dietary requirements), the group results in providing only 12.5 percent (half of the full 25 percent for the class). The actual total percentage value based on nutritional content (a wholesome nutritive food) for an

Table 6.3 Wholesome Food Evaluation for Beef, Milk and Potatoes

	Products					
	Beef		Milk		Potatoes	
Essential Chemicals[a]	Points	%	Points	%	Points	%
Aminoacids (9)						
Isoleucine	1.0		1.0		1.0	
Leucine	1.0		1.0		1.0	
Lysine	1.0		1.0		1.0	
Methionine	1.0		1.0		0.5	
Phenylalanine	1.0		1.0		1.0	
Threonine	1.0		1.0		1.0	
Tryptophan	1.0		1.0		1.0	
Valine	1.0		1.0		1.0	
Other (Chlorine)	0.5		0.5		1.0	
Subtotal[b]	8.5	23.50	8.5	23.50	8.5	23.50
Major Minerals (6)						
Calcium	0.0		1.0		0.0	
Chloride	0.0		0.25		0.0	
Potassium	1.0		1.0		1.0	
Magnesium	0.5		1.0		1.0	
Sodium	0.0		0.25		0.0	
Phospate	1.0		1.0		1.0	
Subtotal	2.5	10.50	4.5	18.75	3.0	12.50
Trace Minerals (10)						
Cobalt	1.0		1.0		1.0	
Chromium	0.25		0.0		1.0	
Copper	1.0		0.25		1.0	
Fluorine	0.5		0.5		1.0	
Iron	1.0		0.0		1.0	
Iodine	0.25		1.0		1.0	
Manganese	0.0		0.0		1.0	
Molybdenum	0.0		0.0		1.0	
Selenium	1.0		0.25		1.0	
Zinc	1.0		1.0		0.5	
Subtotal	6.0	15.00	4.0	10.00	9.5	23.75
Vitamins (13)						
A	0.0		1.0		0.0	
Biotin	0.0		0.25		0.5	
B_6	1.0		0.5		1.0	
B_{12}	1.0		1.0		0.0	
C	0.25		0.5		1.0	

Table 6.3--Continued

Chemicals	Products					
	Beef		Milk		Potatoes	
	Points	%	Points	%	Points	%
D	0.0		1.0		0.0	
E	0.50		0.0		0.0	
Folic Acid	0.0		0.0		0.5	
K	0.0		0.0		0.0	
Niacinamide	1.0		0.0		1.0	
Pantothenic Acid	0.5		1.0		1.0	
Riboflavin	1.0		1.0		0.5	
Thiamin	0.5		0.5		1.0	
Subtotal	5.5	10.50	6.75	12.98	6.5	12.50
Total (100%)[c]		59.50		65.23		72.25

[a]The number in parenthesis is the total number of essential chemicals in each category

[b]The subtotal for each chemical group gives two values for each particular product. The first number provides a value representing how well the product fulfills the daily requirement in each category of chemicals. For example, if a product provides a full daily requirement of aminoacids, its value will be 9.0 points (one point for each of the 9 required aminoacids in the class). The second number is a percentage value representing the relative product contribution (of each chemical category) to a full daily requirement of all essential chemicals. For example, if a product provides a full daily requirement of aminoacids (a total of 9 points), it contributes 25% to a complete daily diet requirement (note that, if each of the four classes of essential chemicals provides a full daily requirement, the product gives 100% of the required diet).

[c]This is the percentage level of a full required diet (under the concept of the wholesome food) provided by each product.

agricultural product is calculated by adding the percentages of each chemical group.

Using this tabulation, the estimates of δ_1 for beef, milk and potatoes are -0.5950, -0.6523 and -0.7225, respectively. It is necessary to be very cautious when interpreting these estimates. The cholesterol and saturated fat issues, which are assumed to impact negatively the consumer's perception of the healthy attributes of animal products, have not been accounted for. Also, there is the continuous discovery of new essential chemicals whose interrelationships (negative or positive) will change the nutritional quality of a product. Furthermore, these estimates are only applicable for an average American male, 20 to 50 years old, weighing 50 kgs, and requiring 2500 calories daily.

The parameter δ_2 (for brand advertising) will be evaluated at one level, -0.3. This level is assumed lower than for δ_1 because these agricultural products are assumed to be basically homogeneous and difficult to differentiate by brand.

Prices P_a, P_b and P_x

The prices for P_a and P_b will be 1.0 and 1.0, respectively. These prices will allow the evaluation of the advertising solution to be interpreted as advertising expenditures for both generic and brand advertising.

The prices for the agricultural products, P_x, are calculated based on the quantity required to provide 2500 calories of energy. This criteria for estimating agricultural prices will simplify the comparison of the advertising effects on agricultural products since

all products can be seen as suppliers of a 2500 calories of energy for a price.

Table 6.4 shows the estimated prices of the three agricultural products producing 2500 calories. For example, the quantity of choice beef needed to produce 2500 calories is calculated at 3.31 lbs. The average price of choice beef is $2.3065 per pound; therefore the price of choice beef required to produce 2500 calories is $7.6345. The prices for milk and potatoes are calculated at $2.2799 and $2.8933, respectively.

Advertising Results on Agricultural Products

The results of simulating adjustments in supply elasticity, demand elasticity, product knowledge, and ratios of advertising parameters on the generic and brand advertising expenditures for beef, milk and potatoes are presented in this section. Of particular interest is the use of the advertising model to compare the effects of these changing structural factors and product attributes on the advertising levels across agricultural products. As in the general simulation presented in the previous chapter, there are two indices that will be used to measure the relative effects of the changing factors on the generic and brand advertising expenditure levels.

The first index (A-index and B-index) is calculated at the following point, δ_1=-0.65, δ_2= -0.30, e_s=0.05, e_d=-0.30 for milk. The A-index at the standard base of reference is calculated by dividing the generic advertising expenditures by itself (7.61/7.61=1.00) (see Table 6.5). The B-index, at the standard base of reference, is obtained by dividing the brand advertising expenditures by the generic advertising

Table 6.4 Estimates of Agricultural Prices to Generate 2500 Calories

Product	Prices	Unit	Quantities[a]	Price per 2500 Calories
Beef	$2.3065[b]	lb.	3.31 lbs	$7.6345
Milk	$2.16[c]	gal.	1.050 gal.	$2.2799
Potatoes	$0.3855[d]	lb.	7.50 lbs	$2.8933

[a]The quantity that need to be consumed to generate 2500 calories

[b]This is an average 1986 price for beef choice from Livestock and Poultry, Situation and Outlook Report, USDA, ERS, Feb. 1987

[c]This is an average 1986 price for fresh low fat milk from Dairy Products Statistics, USDA, ERS, Feb. 1987

[d]This is an average 1986 Baltimore price from Potato Statistics, USDA, ERS, Dec. 1986

expenditures (1.62/7.61=0.21). Thus, the B-index is the value of brand indexed to generic advertising; that is, it shows the proportion of B with respect to A evaluated at the standard base of reference. Remember that these two indices have to be jointly utilized in the evaluation of the advertising model because the model was solved simultaneously for the generic and brand advertising expenditures. All adjustments in structural factors and product attributes for any single product or across products will be compared to this standard base of reference. Milk was chosen as the standard base because the range of values for e_s and e_d for this product had significant estimates and they were relatively smaller than the ones for the other agricultural products.

The second index is the share index, which is calculated as the proportion of generic advertising to total advertising, (A/(A+B)). This index can be utilized to evaluate the adjustments of A and B when the ratio of the advertising parameters changes; and it allows the evaluation of any two cases because it does not depend on any particular standard point of reference.

The results of simulating changes in structural factors and product attributes on the levels of generic and brand advertising for several agricultural products will be presented in two sections. The first section will introduce the advertising analysis for a single agricultural product; in this case, milk was chosen because it was already selected as the standard base of reference. The second section will present an evaluation of the advertising results across beef, milk and potatoes.

Advertising Results for Milk

Adjustments in e_d and e_s

Table 6.5 presents the effects of adjusting levels of e_d and e_s on the relative levels of generic and brand advertising expenditures for milk. A 16.66 percent decrease in $|e_d|$, from -0.30 to -0.25 (holding e_s at 0.05), produces an increase of 21 percent in both A-index, from 1.00 to 1.21, and B-index, from 0.21 to 0.26. A 16.66 percent increase in $|e_d|$, from -0.30 to -0.35, (holding e_s=0.05), decreases by 16 percent both the A-index, from 1.00 to 0.84, and the B-index, from 0.21 to 0.18. This inverse relationship between e_d and the relative levels of A and B is consistent with the results encountered in the general simulation of the advertising model completed in the last chapter. Figure 6.1 illustrates these adjustments of A and B as e_d changes from -0.25 to -0.35 and e_s is held fixed at 0.05.

Similarly, a 100 percent increase in e_s, from 0.05 to 0.10 (holding e_d at -0.30), increases the A-index and the B-index by 86 percent. The A-index changes from 1.00 to 1.86, and the B-index from 0.21 to 0.40. A 200 percent increase in e_s, from 0.05 to 0.15 (holding e_d= -0.30), increases by 158 percent both the A-index (from 1.00 to 2.58) and the B-index (from 0.21 to 0.55). This direct relationship between e_s and the relative levels of A and B can be interpreted through the consumer behavior in the market (see Figure 5.3 and its analysis in the previous chapter). The consumer is willing to accept smaller amounts of advertising for a relatively more inelastic supply because the advertising effect will mainly produce a rather large increase in product price. Only increases in e_s are illustrated in this section.

Table 6.5 Effects of Demand and Supply Elasticities, and Product Knowledge on the Optimal Levels of Generic and Brand Advertising Expenditures for Milk

		Level 1[a]				Level 2[b]			
e_s	e_d	A	B	A Index A/A°	B Index B/A°	A	B	A Index A/A°	B Index B/A°
0.25	-0.35	25.40	5.41	3.34	0.71	16.41	3.50	2.15	0.46
0.25	-0.30	28.28	6.02	3.71	0.79	18.62	3.97	2.45	0.52
0.25	-0.25	31.83	6.78	4.18	0.89	21.39	4.56	2.81	0.60
0.20	-0.35	21.59	4.60	2.84	0.60	13.54	2.88	1.78	0.38
0.20	-0.30	24.27	5.17	3.19	0.68	15.55	3.31	2.04	0.43
0.20	-0.25	27.61	5.88	3.63	0.77	18.11	3.86	2.38	0.51
0.15	-0.35	17.28	3.68	2.27	0.48	10.37	2.21	1.36	0.29
0.15	-0.30	19.65	4.18	2.58	0.55	12.09	2.58	1.59	0.34
0.15	-0.25	22.65	4.83	2.97	0.63	14.32	3.05	1.88	0.40
0.10	-0.35	12.29	2.62	1.61	0.34	6.88	1.47	0.90	0.19
0.10	-0.30	14.19	3.02	1.86	0.40	8.18	1.74	1.07	0.23
0.10	-0.25	16.66	3.55	2.19	0.47	9.92	2.11	1.30	0.28
0.05	-0.35	6.38	1.36	0.84	0.18	3.12	0.66	0.41	0.09
0.05	-0.30	7.61	1.62	1.00	0.21	3.85	0.82	0.51	0.11
0.05	-0.25	9.23	1.97	1.21	0.26	4.86	1.04	0.64	0.14

[a]The numbers in Level 1 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=0, δ_1=-.65, δ_2=-.3, θ_1=.5, θ_2=.5, P_x=$2.27, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A° is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30 and δ_0=0

[b]The numbers in Level 2 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=-1.0, δ_1=-.65, δ_2=-.3, θ_1=.5, θ_2=.5, P_x=$2.27, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A° is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30 and δ_0=0

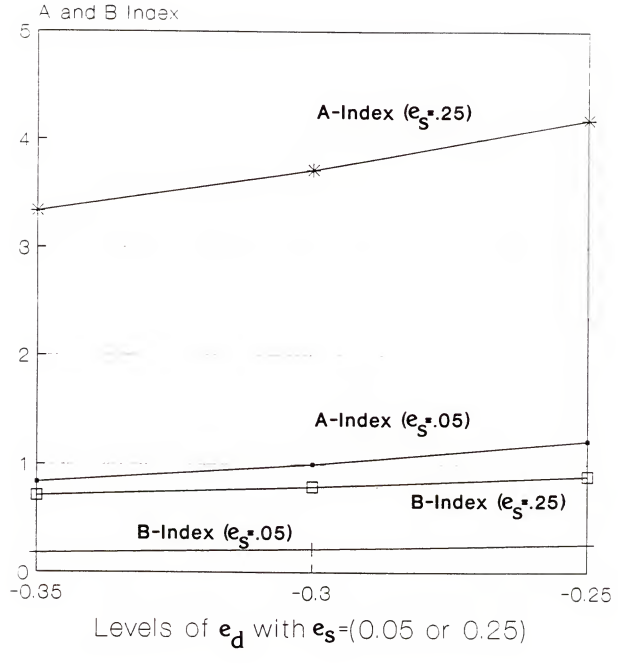

Figure 6.1 Advertising Adjustments to Price Elasticity of Demand with Price Elasticity of Supply at 0.05 and 0.25, for Milk

Decreases in e_s cannot be shown because the standard reference base was calculated at the smallest e_s level. Figure 6.2 illustrates the adjustment process of A and B as e_s varies from 0.05 to 0.25 and e_d is held fixed at -0.30.

The effects of mixed changes in e_d and e_s on the levels of A and B for milk are also shown in Table 6.5. A 100 percent increase in e_s, from 0.05 to 0.10, and a 16.66 percent increase in $|e_d|$, from -0.30 to -0.35, produce a 61 percent increase in both the A-index (from 1.00 to 1.61) and the B-index (from 0.21 to 0.34).

There is an offsetting effect of increasing both e_s and $|e_d|$ on the levels of A and B. An increase in e_s increases the A-index and the B-index, but an increase in $|e_d|$ decreases the A-index and the B-index. For example, when e_s alone increases 100 percent both the A-index and B-index increase by 86 percent. If at the same time $|e_d|$ is also increased by 16.66 percent, the combined increase in both the A-index and the B-index would have been 61 percent. Figure 6.3 illustrates some of the effects of combined changes in e_d and e_s on the levels of A and B. The smallest A-index and B-index, 0.84 and 0.18 are produced by the largest $|e_d|$ (-0.35) and the smallest e_s (0.05). The largest A-index and B-index, 4.18 and 0.89, are generated at the smallest $|e_d|$ (-0.25) and largest e_s (0.25).

Note also from all previous examples that the percentage adjustment of both the A-index and the B-index is the same for any one change of e_d and/or e_s. This occurs because the relative amounts of A and B have to adjust to whatever ratio of δ_1 and δ_2 are estimated in the advertising function. Since this ratio is assumed fixed throughout

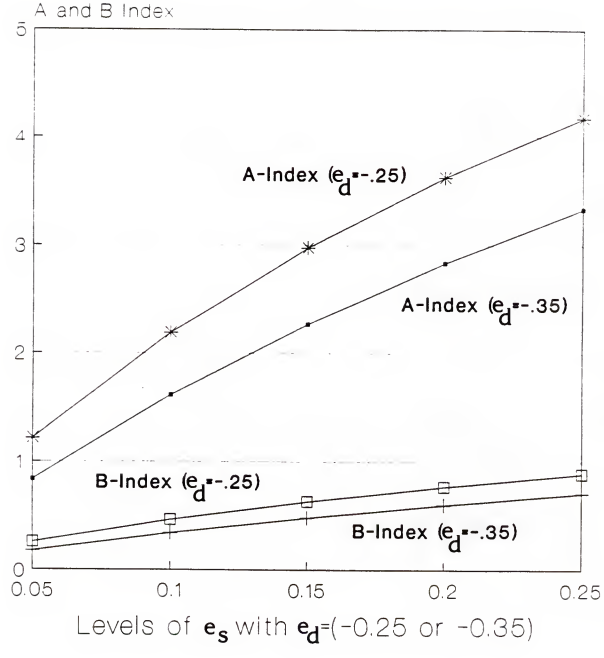

Figure 6.2 Advertising Adjustments to Price Elasticity of Supply with Price Elasticity of Demand at -0.25 and -0.35, for Milk

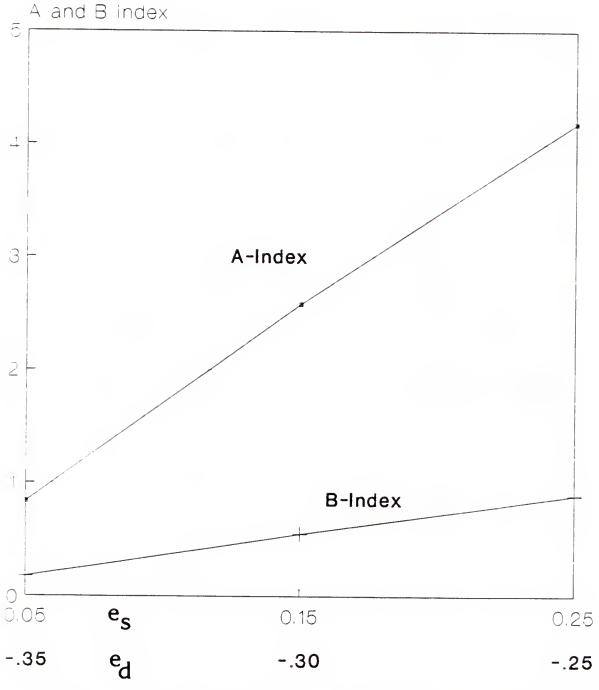

Figure 6.3 Advertising Adjustments to Price Elasticity of Supply and Price Elasticity of Demand, for Milk

this exercise, the level of A and B will adjust accordingly. Still, the actual percentage adjustment of both indices will depend on the level of e_s, the level of e_d and the percentage change of e_s and/or e_d.

The other index used in this study, the share index, also reflects this adjustment process in A and B and is shown to be equal to 0.82 for all simulated points (Table 6.5).

Adjustments in δ_0

An increase in the consumer's knowledge or information about milk from δ_0=0.0 to $|\delta_0|$=-1.0, which is equivalent to an increase from 50 percent to 73 percent of potential product information (holding e_s=0.05 and e_d=-0.30), decreases the A-index (from 1.00 to 0.51) and the B-index (from 0.21 to 0.11) by 49 percent. This result is shown in Table 6.5 and is also consistent with the results obtained in the previous general simulation of the advertising model. As more and more information becomes available about a product (and since there is a finite total amount of product knowledge that the consumer may value), the smaller the quantities of product information that can be provided through advertising; therefore the smaller the levels of both generic and brand advertising needed to reach the optimal advertising levels for the product in the market.

Figure 6.4 illustrates the adjustments of A and B for different levels of product information and different levels of e_d (holding e_s fixed at 0.05). This figure shows that the more inelastic the demand (e_d=-0.25), the higher the levels of indexed values for A and B for both levels of information. When δ_0=0.0, the indexed levels of A and B are 1.21 and 0.26, and when $|\delta_0|$=-1.0, the indexed levels of A and B are

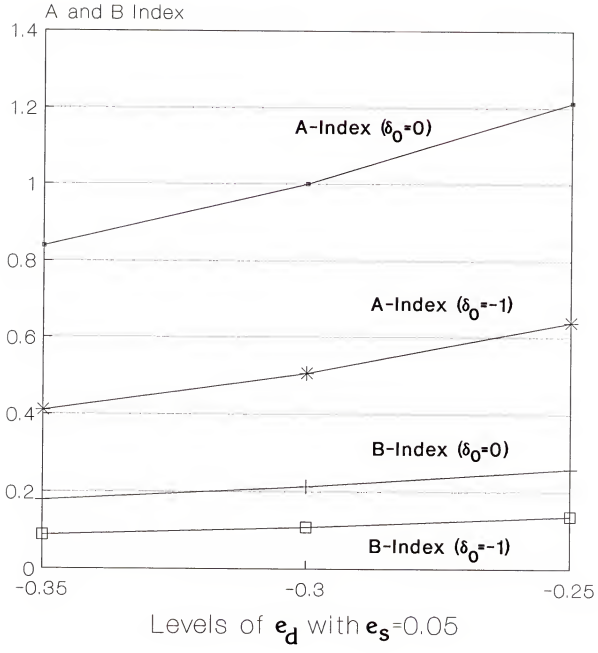

Figure 6.4 Advertising Adjustments to Product Knowledge and Price Elasticity of Demand, for Milk

respectively 0.64 and 0.14. The A-index and the B-index are the highest at the smallest level of product information.

Figure 6.5 shows the adjustments of A and B for different levels of $|\delta_0|$ (0.0 and -1.0) and different levels of e_s (from 0.05 to 0.25), holding e_d at -0.30. The more price elastic the supply (e_s=0.25), the higher the levels of the A-index and the B-index. The highest indexed levels of A and B are reached at 3.71 and 0.79 when e_s=0.25 and δ_0=0.0. The lowest A-index and B-index, 0.51 and 0.11, are obtained when e_s=0.05 and $|\delta_0|$=-1.0.

Advertising Results Across Agricultural Products

Adjustments in δ_0, e_s and e_d

Tables 6.6 and 6.7 present the effects of different levels of e_s, e_d, P_x and δ_0 on the generic and brand advertising expenditures for beef and potatoes, respectively. All the adjustments of generic and brand advertising for these agricultural products have been indexed to the milk standard base of reference; i.e., δ_0=0.0, δ_1=-0.65, δ_2= -0.3, P_x=$2.27, e_s=0.05 and e_d=-0.30. Therefore, the A-index and the B-index used in this evaluation will represent a measure of the combined effects of all those changing factors on A and B across agricultural products relative to the advertising levels for milk at the base point of reference.

The indexed values of generic and brand advertising for all combinations of the minimum and maximum values of e_s and e_d for each agricultural product are presented in Table 6.8. This set of indexed values of A and B provides a sample of the relative estimated quantities of generic and brand advertising under different levels of

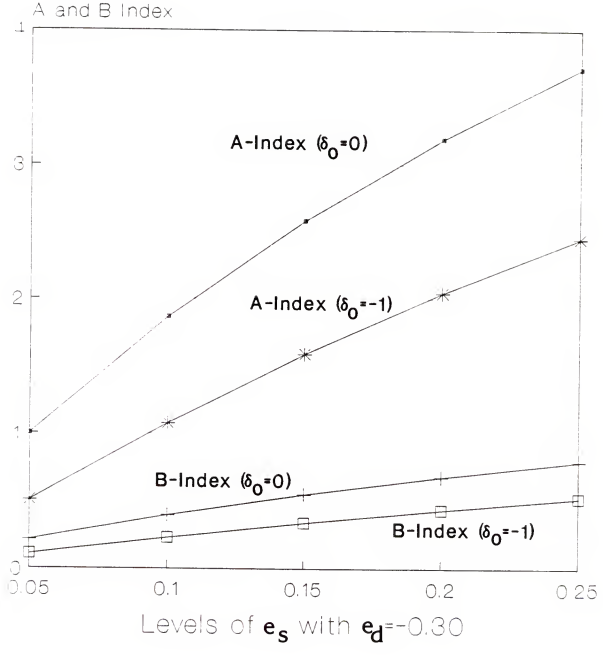

Figure 6.5 Advertising Adjustments to Product Knowledge and Price Elasticity of Supply, for Milk

Table 6.6 Effects of Demand and Supply Elasticities, and Product Knowledge on the Optimal Levels of Generic and Brand Advertising Expenditures for Beef

		Level 1[a]				Level 2[b]			
e_s	e_d	A	B	A Index A/A∘	B Index B/A∘	A	B	A Index A/A∘	B Index B/A∘
0.50	-0.65	44.12	11.03	5.79	1.45	30.80	7.70	4.05	1.01
0.50	-0.60	46.20	11.55	6.07	1.52	32.48	8.12	4.27	1.07
0.50	-0.55	48.49	12.12	6.37	1.59	34.35	8.59	4.51	1.13
0.50	-0.50	51.04	12.76	6.70	1.68	36.43	9.11	4.78	1.20
0.50	-0.45	53.88	13.47	7.08	1.77	38.78	9.69	5.09	1.27
0.50	-0.40	57.09	14.27	7.50	1.87	41.43	10.36	5.44	1.36
0.45	-0.65	41.32	10.33	5.43	1.36	28.55	7.14	3.75	0.94
0.45	-0.60	43.35	10.84	5.69	1.42	30.18	7.54	3.96	0.99
0.45	-0.55	45.60	11.40	5.99	1.50	32.00	8.00	4.20	1.05
0.45	-0.50	48.11	12.03	6.32	1.58	34.04	8.51	4.47	1.12
0.45	-0.45	50.93	12.73	6.69	1.67	36.35	9.09	4.77	1.19
0.45	-0.40	54.12	13.53	7.11	1.78	38.97	9.74	5.12	1.28
0.40	-0.65	38.26	9.56	5.02	1.26	26.11	6.53	3.43	0.86
0.40	-0.60	40.23	10.06	5.28	1.32	27.68	6.92	3.63	0.91
0.40	-0.55	42.42	10.61	5.57	1.39	29.43	7.36	3.87	0.97
0.40	-0.50	44.88	11.22	5.89	1.47	31.41	7.85	4.13	1.03
0.40	-0.45	47.65	11.91	6.26	1.56	33.66	8.42	4.42	1.11
0.40	-0.40	50.80	12.70	6.67	1.67	36.24	9.06	4.76	1.19
0.35	-0.65	35.06	8.77	4.61	1.15	23.58	5.89	3.10	0.77
0.35	-0.60	36.96	9.24	4.85	1.21	25.07	6.27	3.29	0.82
0.35	-0.55	39.07	9.77	5.13	1.28	26.75	6.69	3.51	0.88
0.35	-0.50	41.45	10.36	5.44	1.36	28.65	7.16	3.76	0.94
0.35	-0.45	44.15	11.04	5.80	1.45	30.82	7.70	4.05	1.01
0.35	-0.40	47.23	11.81	6.20	1.55	33.32	8.33	4.38	1.09
0.30	-0.65	31.52	7.88	4.14	1.03	20.81	5.20	2.73	0.68
0.30	-0.60	33.31	8.33	4.37	1.09	22.20	5.55	2.92	0.73
0.30	-0.55	35.32	8.83	4.64	1.16	23.78	5.94	3.12	0.78
0.30	-0.50	37.59	9.40	4.94	1.23	25.57	6.39	3.36	0.84
0.30	-0.45	40.17	10.04	5.28	1.32	27.63	6.91	3.63	0.91
0.30	-0.40	43.15	10.79	5.67	1.42	30.02	7.50	3.94	0.99
0.25	-0.65	27.69	6.92	3.64	0.91	17.86	4.47	2.35	0.59
0.25	-0.60	29.35	7.34	3.86	0.96	19.14	4.78	2.51	0.63
0.25	-0.55	31.23	7.81	4.10	1.03	20.58	5.15	2.70	0.68
0.25	-0.50	33.35	8.34	4.38	1.10	22.23	5.56	2.92	0.73

Table 6.6--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A∘	Level 1[a] B Index B/A∘	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A∘	Level 2[b] B Index B/A∘
0.25	-0.45	35.79	8.95	4.70	1.18	24.14	6.04	3.17	0.79
0.25	-0.40	38.61	9.65	5.07	1.27	26.38	6.60	3.46	0.87
0.20	-0.65	23.52	5.88	3.09	0.77	14.72	3.68	1.93	0.48
0.20	-0.60	25.03	6.26	3.29	0.82	15.85	3.96	2.08	0.52
0.20	-0.55	26.74	6.68	3.51	0.88	17.14	4.28	2.25	0.56
0.20	-0.50	28.68	7.17	3.77	0.94	18.62	4.65	2.44	0.61
0.20	-0.45	30.91	7.73	4.06	1.01	20.33	5.08	2.67	0.67
0.20	-0.40	33.52	8.38	4.40	1.10	22.36	5.59	2.94	0.73
0.15	-0.65	18.91	4.73	2.48	0.62	11.35	2.84	1.49	0.37
0.15	-0.60	20.23	5.06	2.66	0.66	12.31	3.08	1.62	0.40
0.15	-0.55	21.73	5.43	2.85	0.71	13.40	3.35	1.76	0.44
0.15	-0.50	23.43	5.86	3.08	0.77	14.65	3.66	1.92	0.48
0.15	-0.45	25.40	6.35	3.34	0.83	16.12	4.03	2.12	0.53
0.15	-0.40	27.71	6.93	3.64	0.91	17.87	4.47	2.35	0.59

[a]The numbers in Level 1 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=0, δ_1=-.60, δ_2=-.3, θ_1=.5, θ_2=.5, P_x=$7.63, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30, P_x=$2.27, and δ_0=0 for milk

[b]The numbers in Level 2 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=-1.0, δ_1=-.65, δ_2=-.3, θ_1=.5, θ_2=.5, P_x=$7.63, P_a=$1.0 and P_b=$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A∘ is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30, P_x=$2.27, and δ_0=0 for milk

Table 6.7 Effects of Demand and Supply Elasticities, and Product Knowledge on the Optimal Levels of Generic and Brand Advertising Expenditures for Potatoes

		Level 1[a]				Level 2[b]			
e_s	e_d	A	B	A Index A/A∘	B Index B/A∘	A	B	A Index A/A∘	B Index B/A∘
0.80	-0.35	48.34	8.39	6.35	1.10	35.43	6.15	4.65	0.81
0.80	-0.30	50.96	8.85	6.69	1.16	37.63	6.53	4.94	0.86
0.80	-0.25	53.89	9.36	7.08	1.23	40.09	6.96	5.27	0.91
0.80	-0.20	57.17	9.93	7.51	1.30	42.87	7.44	5.63	0.98
0.80	-0.15	60.89	10.57	8.00	1.39	46.03	7.99	6.05	1.05
0.75	-0.35	47.13	8.18	6.19	1.07	34.42	5.98	4.52	0.78
0.75	-0.30	49.81	8.65	6.54	1.14	36.66	6.37	4.82	0.84
0.75	-0.25	52.82	9.17	6.94	1.20	39.19	6.80	5.15	0.89
0.75	-0.20	56.21	9.76	7.38	1.28	42.06	7.30	5.52	0.96
0.75	-0.15	60.07	10.43	7.89	1.37	45.33	7.87	5.95	1.03
0.70	-0.35	45.84	7.96	6.02	1.05	33.35	5.79	4.38	0.76
0.70	-0.30	48.58	8.43	6.38	1.11	35.63	6.19	4.68	0.81
0.70	-0.25	51.66	8.97	6.78	1.18	38.22	6.64	5.02	0.87
0.70	-0.20	55.17	9.58	7.25	1.26	41.17	7.15	5.41	0.94
0.70	-0.15	59.18	10.27	7.77	1.35	44.57	7.74	5.85	1.02
0.65	-0.35	44.36	7.70	5.83	1.01	32.12	5.58	4.22	0.73
0.65	-0.30	47.15	8.19	6.19	1.08	34.45	5.98	4.52	0.79
0.65	-0.25	50.32	8.74	6.61	1.15	37.09	6.44	4.87	0.85
0.65	-0.20	53.94	9.37	7.08	1.23	40.14	6.97	5.27	0.92
0.65	-0.15	58.12	10.09	7.63	1.33	43.68	7.58	5.74	1.00
0.60	-0.35	42.73	7.42	5.61	0.97	30.78	5.34	4.04	0.70
0.60	-0.30	45.58	7.91	5.99	1.04	33.14	5.75	4.35	0.76
0.60	-0.25	48.83	8.48	6.41	1.11	35.84	6.22	4.71	0.82
0.60	-0.20	52.57	9.13	6.90	1.20	38.98	6.77	5.12	0.89
0.60	-0.15	56.93	9.88	7.48	1.30	42.66	7.41	5.60	0.97
0.55	-0.35	41.00	7.12	5.39	0.93	29.35	5.10	3.85	0.67
0.55	-0.30	43.89	7.62	5.76	1.00	31.74	5.51	4.17	0.72
0.55	-0.25	47.22	8.20	6.20	1.08	34.50	5.99	4.53	0.79
0.55	-0.20	51.07	8.87	6.71	1.16	37.72	6.55	4.95	0.86
0.55	-0.15	55.61	9.65	7.30	1.27	41.55	7.21	5.46	0.95
0.50	-0.35	39.01	6.77	5.12	0.89	27.72	4.81	3.64	0.63
0.50	-0.30	41.93	7.28	5.51	0.96	30.12	5.23	3.96	0.69

Table 6.7--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A*	Level 1[a] B Index B/A*	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A*	Level 2[b] B Index B/A*
0.50	-0.25	45.33	7.87	5.95	1.03	32.92	5.72	4.32	0.75
0.50	-0.20	49.30	8.56	6.48	1.12	36.24	6.29	4.76	0.83
0.50	-0.15	54.03	9.38	7.10	1.23	40.22	6.98	5.28	0.92
0.45	-0.35	36.94	6.41	4.85	0.84	26.02	4.52	3.42	0.59
0.45	-0.30	39.88	6.92	5.24	0.91	28.43	4.94	3.73	0.65
0.45	-0.25	43.32	7.52	5.69	0.99	31.26	5.43	4.11	0.71
0.45	-0.20	47.41	8.23	6.23	1.08	34.65	6.02	4.55	0.79
0.45	-0.15	52.32	9.08	6.87	1.19	38.77	6.73	5.09	0.88
0.40	-0.35	34.61	6.01	4.54	0.79	24.13	4.19	3.17	0.55
0.40	-0.30	37.55	6.52	4.93	0.86	26.52	4.60	3.48	0.60
0.40	-0.25	41.03	7.12	5.39	0.94	29.37	5.10	3.86	0.67
0.40	-0.20	45.20	7.85	5.94	1.03	32.82	5.70	4.31	0.75
0.40	-0.15	50.30	8.73	6.61	1.15	37.08	6.44	4.87	0.85
0.35	-0.35	32.09	5.57	4.21	0.73	22.11	3.84	2.90	0.50
0.35	-0.30	35.01	6.08	4.60	0.80	24.46	4.25	3.21	0.56
0.35	-0.25	38.49	6.68	5.06	0.88	27.29	4.74	3.58	0.62
0.35	-0.20	42.73	7.42	5.61	0.97	30.77	5.34	4.04	0.70
0.35	-0.15	48.00	8.33	6.30	1.09	35.15	6.10	4.62	0.80
0.30	-0.35	29.20	5.07	3.83	0.67	19.81	3.44	2.60	0.45
0.30	-0.30	32.05	5.56	4.21	0.73	22.08	3.83	2.90	0.50
0.30	-0.25	35.51	6.16	4.66	0.81	24.86	4.32	3.27	0.57
0.30	-0.20	39.77	6.91	5.22	0.91	28.34	4.92	3.72	0.65
0.30	-0.15	45.18	7.84	5.93	1.03	32.80	5.69	4.31	0.75
0.25	-0.35	25.96	4.51	3.41	0.59	17.26	3.00	2.27	0.39
0.25	-0.30	28.71	4.98	3.77	0.65	19.42	3.37	2.55	0.44
0.25	-0.25	32.07	5.57	4.21	0.73	22.09	3.84	2.90	0.50
0.25	-0.20	36.30	6.30	4.77	0.83	25.50	4.43	3.35	0.58
0.25	-0.15	41.78	7.25	5.49	0.95	29.99	5.21	3.94	0.68
0.20	-0.35	22.32	3.88	2.93	0.51	14.45	2.51	1.90	0.33
0.20	-0.30	24.88	4.32	3.27	0.57	16.42	2.85	2.16	0.37
0.20	-0.25	28.07	4.87	3.69	0.64	18.91	3.28	2.48	0.43
0.20	-0.20	32.16	5.58	4.22	0.73	22.16	3.85	2.91	0.51
0.20	-0.15	37.61	6.53	4.94	0.86	26.57	4.61	3.49	0.61

Table 6.7--Continued

e_s	e_d	Level 1[a] A	Level 1[a] B	Level 1[a] A Index A/A°	Level 1[a] B Index B/A°	Level 2[b] A	Level 2[b] B	Level 2[b] A Index A/A°	Level 2[b] B Index B/A°
0.15	-0.35	18.16	3.15	2.39	0.41	11.33	1.97	1.49	0.26
0.15	-0.30	20.44	3.55	2.68	0.47	13.04	2.26	1.71	0.30
0.15	-0.25	23.33	4.05	3.06	0.53	15.24	2.65	2.00	0.35
0.15	-0.20	27.12	4.71	3.56	0.62	18.18	3.16	2.39	0.41
0.15	-0.15	32.34	5.61	4.25	0.74	22.32	3.88	2.93	0.51

[a]The numbers in Level 1 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=0, δ_1=-.72, δ_2=-.3, θ_1=.5, θ_2=.5, P_x=\$2.89, P_a=\$1.0 and P_b=\$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A° is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30, P_x=\$2.27, and δ_0=0 for milk

[b]The numbers in Level 2 have been obtained by holding the following advertising parameters fixed at: α_0=70.0, β_0=.5, δ_0=-1.0, δ_1=-.72, δ_2=-.3, θ_1=.5, θ_2=.5, P_x=\$2.89, P_a=\$1.0 and P_b=\$1.0. A is the level of generic advertising expenditures. B is the level of brand advertising expenditures. A° is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30, P_x=\$2.27, and δ_0=0 for milk

Table 6.8 Advertising Responses to Maximum and Minimum Values of Elasticities of Supply and Demand, Under a Relatively Low Product Knowledge for Beef, Milk and Potatoes

	e_s	e_d	A[a]	B[b]	A[c] Index A/A∘	B Index B/A∘	Total[d] Index	Share Index A/A+B
Milk	0.05	-0.35	6.38	1.36	0.84	0.18	1.02	0.82
	0.05	-0.25	9.23	1.97	1.21	0.26	1.47	0.82
δ_1=-.65	0.25	-0.35	25.40	5.41	3.34	0.71	4.05	0.82
P_x=$2.27	0.25	-0.25	31.83	6.78	4.18	0.89	5.07	0.82
Beef	0.15	-0.65	18.91	4.73	2.48	0.62	3.10	0.80
	0.15	-0.40	27.71	6.93	3.64	0.91	4.55	0.80
δ_1=-.60	0.50	-0.65	44.12	11.03	5.79	1.45	7.24	0.80
P_x=$7.63	0.50	-0.40	57.09	14.27	7.50	1.87	9.37	0.80
Potatoes	0.15	-0.35	18.16	3.15	2.39	0.41	2.80	0.85
	0.15	-0.15	32.34	5.61	4.25	0.74	4.98	0.85
δ_1=-.72	0.80	-0.35	48.34	8.39	6.35	1.10	7.45	0.85
P_x=$2.89	0.80	-0.15	60.89	10.57	8.00	1.39	9.38	0.85

[a]A is generic advertising expenditures

[b]B is brand advertising expenditures

[c]A∘ is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30, P_x=$2.27, and δ_0=0 for milk

[d]This index is the sum of A-Index and B-Index

price elasticities of supply and demand across different agricultural products. This table shows that the smallest indexed values of generic and brand advertising are obtained for each agricultural product at the combination of the smallest (more inelastic) supply elasticity and the largest (less inelastic) demand elasticity of each agricultural product. The largest indexed levels of A and B are obtained for each agricultural product at the combination of the largest e_s and smallest $|e_d|$.

The smallest indexed levels of A and B for milk (e_s=0.05 and $|e_d|$=-0.35), beef (e_s=0.15 and $|e_d|$=-0.65) and potatoes (e_s=0.15 and $|e_d|$=-0.35), holding the level of current knowledge for all products at 50 percent (δ_0=0.0), are (0.84, 0.18), (2.48, 0.62), and (2.39, 0.41), respectively. Under these conditions, beef will use more generic and brand advertising than potatoes and milk. This occurs because the price for beef ($7.63) is relatively higher than the prices for potatoes ($2.89) and milk ($2.27), and also because its generic parameter ($|\delta_1|$=-.60) is relatively less efficient than the ones for potatoes ($|\delta_1|$=-.72) and milk ($|\delta_1|$=-.65). The product potatoes will use more generic and brand advertising than milk because its price and e_s are relatively higher than those for milk.

Similarly, the largest indexed values of A and B for milk (e_s=0.25 and $|e_d|$=-0.25), beef (e_s=0.50 and $|e_d|$=-0.40) and potatoes (e_s=0.80 and $|e_d|$= -0.15), holding δ_0=0.0, are (4.18, 0.89), (7.50, 1.87), and (8.00, 1.39), respectively. Under these conditions, potatoes will use more generic advertising than beef and milk. This occurs because of the relative larger e_s and smaller $|e_d|$ for potatoes compared to beef and milk. The product beef will use more brand advertising than potatoes

and milk because the combination of low $|\delta_2|$ and high price generates a larger expenditure in brand advertising.

Table 6.8 also includes two additional columns, one representing the relative level of total advertising (generic + brand) expenditures and the other presenting the calculated share index. It is found that at the smallest e_s and largest $|e_d|$ for each product (and under the assumptions of equal knowledge for all products and different agricultural product prices calculated to provide 2500 calories of energy), total advertising (generic + brand) expenditures are greater for beef (3.10), followed by potatoes (2.80) and milk (1.02). The share index (the proportion of generic to total advertising expenditures) is estimated at 80, 85 and 82 percent for beef, potatoes and milk, respectively.

Similarly, at the largest e_s and smallest $|e_d|$, total advertising expenditures are greater for potatoes (9.39), followed by beef (9.37) and milk (5.07). This switch between potatoes and beef to the first position, compared to the evaluation at the smallest e_s and largest $|e_d|$, is due to a relatively larger price elasticity of supply for potatoes (e_s=0.80), which generates a large increase in advertising (in particular, generic advertising). This same evaluation on the different relative total advertising expenditures for beef, milk and potatoes, can be completed for any other level of e_s and e_d. For example, when the e_s and e_d for milk, beef and potatoes are 0.25 and -0.35, 0.50 and -0.65 and, 0.80 and -0.35, respectively, the total advertising expenditures are greater for potatoes (7.45), followed by beef (7.24) and milk (4.05).

In this hypothetical situation, the combined effects of the specific levels assumed for product knowledge, elasticity of supply and demand, product price, and the generic and brand parameters indicate that milk does not need as much total advertising (generic and brand) relative to beef and potatoes because milk has a relative smaller e_s than the other two products, and also because the price for milk is relatively smaller than the price for beef and potatoes (the price / 2500 calories of energy).

Table 6.9 presents the evaluation of the advertising model across agricultural products when the knowledge for each product has increased from 50 percent (δ_0=0.0) to 73 percent ($|\delta_0|$=-1.0). For example, if consumers are well informed about milk, beef and potatoes (due to many years of advertising and other educational programs) the market for these three products shows decreasing levels of advertising in their A-index and B-index. The indices for A and B for the product milk (at the smallest e_s and largest $|e_d|$) are 0.41 and 0.09 when the product knowledge is 73 percent. These same indices are 0.84 and 0.18 when the knowledge of the product milk is decreased to 50 percent.

In terms of levels of total advertising expenditures (Table 6.9), beef has the highest relative level, at 1.86, followed by potatoes (1.75) and milk (0.50), when product knowledge is increased to 73 percent ($|\delta_0|$=-1.0).

Adjustments in δ_1, δ_2 and P_x

To finalize this chapter on simulating the effects of advertising on agricultural products, Table 6.10 presents the effects of the generic (δ_1) and brand (δ_2) advertising parameters and the price of the

Table 6.9 Advertising Responses to Maximum and Minimum Values of Elasticities of Supply and Demand, Under a Relatively High Product Knowledge for Beef, Milk and Potatoes

	e_s	e_d	A[a]	B[b]	A[c] Index A/A∘	B Index B/A∘	Total[d] Index	Share Index A/A+B
Milk	0.05	-0.35	3.12	0.66	0.41	0.09	0.50	0.82
	0.05	-0.25	4.86	1.04	0.64	0.14	0.77	0.82
δ_1=-.65	0.25	-0.35	16.41	3.50	2.15	0.46	2.61	0.82
P_x=$2.27	0.25	-0.25	21.39	4.56	2.81	0.60	3.41	0.82
Beef	0.15	-0.65	11.35	2.84	1.49	0.37	1.86	0.80
	0.15	-0.40	17.87	4.47	2.35	0.59	2.93	0.80
δ_1=-.60	0.50	-0.65	30.80	7.70	4.05	1.01	5.06	0.80
P_x=$7.63	0.50	-0.40	41.43	10.36	5.44	1.36	6.80	0.80
Potatoes	0.15	-0.35	11.33	1.97	1.49	0.26	1.75	0.85
	0.15	-0.15	22.32	3.88	2.93	0.51	3.44	0.85
δ_1=-.72	0.80	-0.35	35.43	6.15	4.65	0.81	5.46	0.85
P_x=$2.89	0.80	-0.15	46.03	7.99	6.05	1.05	7.10	0.85

[a]A is generic advertising expenditures

[b]B is brand advertising expenditures

[c]A∘ is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30, P_x=$2.27, and δ_0=0 for milk

[d]This index is the sum of A-Index and B-Index

Table 6.10 Effects of Advertising Parameters on Optimal Generic and Brand Advertising Expenditures for Beef, Milk and Potatoes Assuming Equal Elasticities of Supply and Demand

	e_s	e_d	A[a]	B[b]	A[c] Index A/A•	B Index B/A•	Total[d] Index
Milk	0.05	-0.35	6.38	1.36	0.84	0.18	1.02
	0.05	-0.25	9.23	1.97	1.21	0.26	1.47
δ_1=-.65	0.25	-0.35	25.40	5.41	3.34	0.71	4.05
P_x=$2.27	0.25	-0.25	31.83	6.78	4.18	0.89	5.07
Beef	0.05	-0.35	13.95	3.49	1.83	0.46	2.29
	0.05	-0.25	18.46	4.61	2.42	0.61	3.03
δ_1=-.60	0.25	-0.35	41.94	10.48	5.51	1.38	6.88
P_x=$7.63	0.25	-0.25	50.76	12.69	6.67	1.67	8.33
Potatoes	0.05	-0.35	7.37	1.28	0.97	0.17	1.14
	0.05	-0.25	10.25	1.78	1.35	0.23	1.58
δ_1=-.72	0.25	-0.35	25.96	4.51	3.41	0.59	4.00
P_x=$2.89	0.25	-0.25	32.07	5.57	4.21	0.73	4.94

[a]A is generic advertising expenditures

[b]B is brand advertising expenditures

[c]A• is the level of generic advertising expenditures used as the reference base at e_s=.05, e_d=-.30, P_x=$2.27, and δ_0=0 for milk

[d]This index is the sum of A-index and B-index

product (P_x) on the indexed levels of advertising expenditures across agricultural products. This simulation assumes that the ranges of e_s and e_d for all agricultural products are the same and are set to the e_s and e_d levels assumed for milk. Taking away the effects of different ranges in e_d and e_s allows the evaluation of the advertising model in terms of two important factors determining the advertising levels, the product attributes (in particular the nutritional characteristics of the agricultural products) through δ_1 and δ_2, and their respective agricultural prices.

The largest indexed levels of A and B for milk, beef and potatoes (at e_s=0.25 and $|e_d|$=-0.25) are: (4.18, 0.89), (6.67, 1.67) and (4.21, 0.73), respectively. The nutritional properties of the agricultural products (evaluated through the concept of wholesome nutritious food) and their prices needed to provide 2500 calories of energy (per day), partially indicate that the optimal expenditure levels of generic advertising for milk should be similar to that of potatoes but less than for beef.

Note that the order of potatoes and beef has changed compared to when advertising expenditures were affected by their own products' elasticities of supply and demand. At a relatively low level of e_s (milk's range) the product potatoes does not need as much generic advertising compared to beef since its price is smaller and its generic parameter is higher. The generic advertising indices for potatoes and milk are similar because the larger generic parameter assumed for potatoes (compared to milk) is offset by the lower price assumed for milk (compared to potatoes).

Similarly, the optimal expenditure levels of brand advertising should be lower forr potatoes than for milk and beef. The level of brand advertising expenditures is partly determined by the level of generic advertising expenditures. This occurs because both A and B advertising adjust to the ratio of δ_1 and δ_2 (which is held fixed in the model).

Total advertising expenditures for milk, beef and potatoes (given e_s=0.25 and e_d=-0.25) were calculated at 5.07, 8.34 and 4.94, respectively. The optimal levels of brand advertising for potatoes should be less than for milk and beef. These results are consistent with those obtained for the largest indexed levels of A and B. These total advertising expenditures again show the conditions of relative low price and relative high generic parameter of potatoes compared with milk and beef.

The smallest indexed levels of A and B for milk, beef and potatoes (at e_s=0.05 and $|e_d|$=-0.35) are determined as (0.84, 0.18), (1.83, 0.46) and (0.97, 0.17), respectively. The optimal levels of generic advertising expenditures for milk should be less than for potatoes and beef. The optimal levels of brand advertising for potatoes should be less than for milk and beef. These results are consistent with those obtained for the largest indexed levels of A and B, given the assumed levels for δ_1 and δ_2. The relative total advertising expenditures for milk, beef and potatoes were calculated as 1.02, 2.29 and 1.14 (Figure 6.6).

Figures 6.7 illustrates the previous analysis of the smallest indexed generic and brand advertising levels for milk and beef. Figure

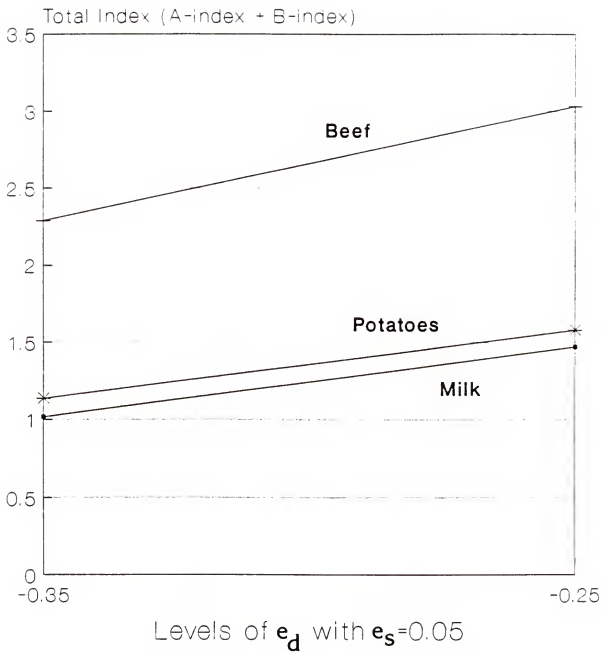

Figure 6.6 Advertising for Beef, Milk and Potatoes

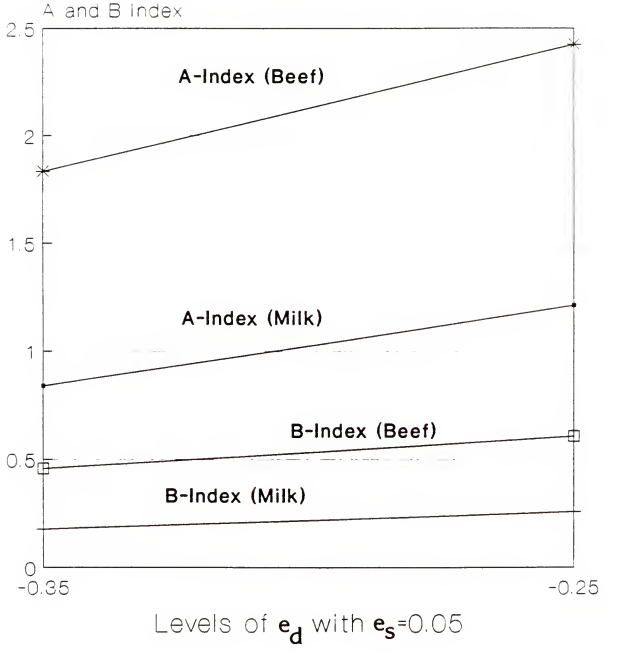

Figure 6.7 Advertising Adjustments on Beef and Milk

6.8 presents a similar analysis for milk and potatoes and Figure 6.9 shows the case of beef and potatoes. For all three figures, the A-index and the B-index are presented at two different levels of e_d (-0.25 and -0.35) while e_s is held fixed at 0.05.

The comparison of the generic and brand advertising levels for beef, milk and potatoes has been determined through the analysis of the nutritional property of the product based on the concept of wholesome food, the levels of e_s and e_d, and the product price resulting from the need to produce 2500 calories of energy.

Potatoes (providing 72.25 percent of good nutritional value) are clearly favorable to milk (65.23 percent) and beef (59.50 percent) based on the concept of wholesome food. Note that the issue of cholesterol has not been included in this definition. The price necessary to fulfill the dietary requirement of consumption of 2500 calories ranges from $2.27 for milk, $2.89 for potatoes and $7.63 for beef.

The advertising levels for beef are expected to be higher than for potatoes and milk since its generic parameter (δ_1) is smaller and its price is relatively higher compared to the other two products. The order of the advertising levels for milk and potatoes is not so clear because even though potatoes are assumed to be more nutritious than milk, the price of milk necessary to produce the 2500 calories of energy is lower than for potatoes. It seems that the particular combination of a relatively small e_s (0.05) and a relatively large $|e_d|$ (-0.35) coupled to the level of the parameter δ_1 (-.65) and its price ($2.27) for milk work together to produce a relative lower level of total advertising compared to potatoes. In contrast, when e_s is relatively large (0.25)

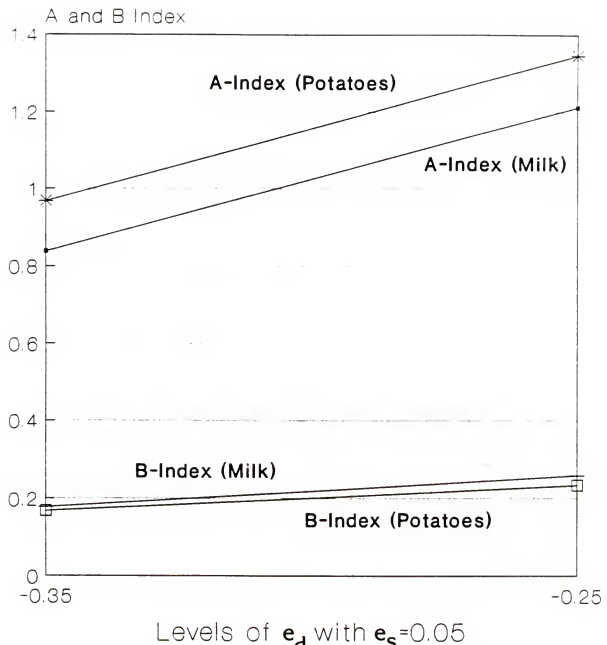

Figure 6.8 Advertising Adjustments on Milk and Potatoes

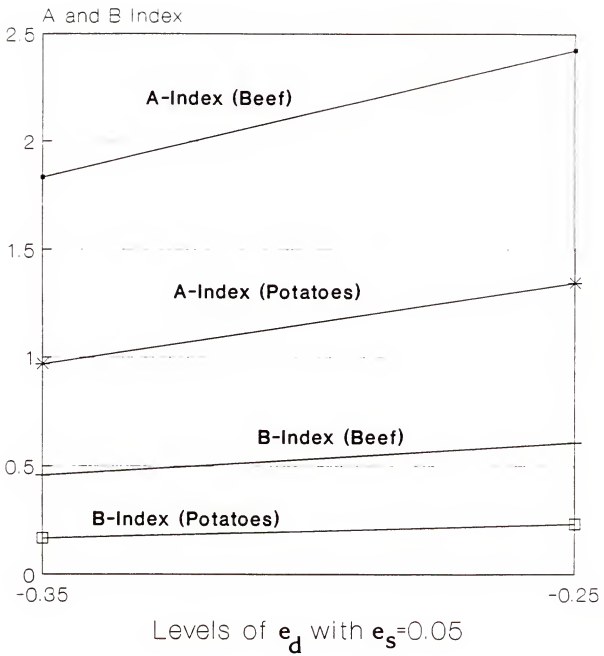

Figure 6.9 Advertising Adjustments on Beef and Potatoes

and $|e_d|$ is relatively small (-0.25), the product potatoes with its parameter δ_1 at -0.72 and its price of $2.89, will have a relative lower level of total advertising compared to milk.

In general, for those agricultural products whose generic and brand advertising parameters are very similar in value, there is a whole set of factors that can be utilized to either increase or reduce (whichever the case may be) the advertising expenditures. The particular product price, the product attributes that regulate the impact of the generic (δ_1) and brand (δ_2) advertising parameters, and the structural factors that determine the price elasticity of demand and supply can each influence the final result.

Concluding Comments

This chapter has presented two hypothetical situations on the use of generic and brand advertising in the marketing of agricultural products. In the first situation is illustrated the effects of different levels of product knowledge, and supply and demand elasticities on the levels of generic and brand advertising expenditures for milk. In the second situation, the effects of different product attributes and market structural factors on the levels of generic and brand advertising are compared for milk, beef and potatoes.

The assumed values for the generic advertising parameters for all three agricultural products have been obtained using the concept of a "wholesome nutritive good" defined by Williams (1977). This concept shows the percentage of the essential elements that a particular food product provides for the daily requirement of a specific person (i.e.,

an average American male, 20 to 50 years old, weighing 50 kgs., and requiring 2500 calories daily); and it is only a relative measure of the nutritional value of a food product since it can be updated with the continuous discovery of new essential chemicals whose interrelationships will change the nutritional quality of a product.

It should be noted also that only the nutritive characteristics of a product have been used to obtain a value for the generic advertising parameter. In reality, several other product attributes such as identification, homogeneity, and grades and standards should also be included when obtaining a value for this advertising parameter. Any other potential methodology used (or needed) to obtain estimates for the advertising parameters should be consistent with the particular purpose of the study.

The values assumed for the price elasticities of demand and supply in this thesis were obtained from separate studies and they range from being quite robust to slightly significant estimates. Thus, it is necessary to be very cautious when interpreting these estimates.

The purpose of this chapter was to illustrate the potential effects of advertising factors on the advertising levels across agricultural products. The results are consistent with those encountered in the previous chapter, where a general simulation of the effects of product attributes and structural factors on generic and brand advertising expenditures was completed.

CHAPTER VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the Study

Two kinds of advertising are currently used in the marketing of agricultural products. Brand advertising is a well-established marketing tool by which a particular producer promotes its own brand with the expectation of increasing its share of the market. This gain occurs through brand shifting as well as with growth in the total amount of product consumed. Generic promotion is a relatively more recent type of advertising by means of which producers cooperate and jointly promote a particular product. The brand type of advertising can be perceived as either a form of persuasion that creates product differentiation and thus leads to greater market power, or as a source of information through factual advertising. On the other hand, generic promotion is viewed as an inexpensive means for current and potential buyers to assimilate data about different products and therefore it should enhance competition.

This study has developed a theoretical model of advertising where both generic and brand promotions are included. The consumer is introduced in the model as the receiving end of the information (and/or persuasion) provided by either or both types of advertising. It is assumed that the consumer maximizes his utility, where utility is directly generated by the consumption of a commodity characteristic.

The commodity characteristic is produced (through a household production function) with several inputs, such as products bought in the market, and different types of advertising.

Under these assumptions, the optimal levels of market goods are obtained given the levels of both generic and brand advertising. The model then is utilized to show the impacts in the optimal solution of changes in generic and brand advertising. The consumer is willing to pay a higher price for the advertised product if this increase in price brings along an equivalent amount of information obtained from product advertisement.

The producer is introduced in the model as the supplier of advertising. The producer is assumed to be a profit maximizer who will use the level of advertising where the marginal revenue of each type of advertising equals the respective marginal cost.

The formulation of the advertising model is completed by introducing supply and demand factors through the price elasticities of supply and demand, and the product attributes through the advertising function.

The model was made operational by specifying a double log function for the commodity characteristic produced by the consumer, from which the demand for the market product X was derived; a double log function for the supply of X; and a logistic functional form for the advertising function.

The final result of this advertising model was a set of two equations representing the implicit prices of generic (A) and brand (B) advertising. These two equations can be solved simultaneously for the

optimal generic and brand advertising expenditures under a range of different scenarios relating to product attributes and market characteristics.

The constructed model was utilized to simulate an advertising situation where both generic and brand advertising were optimally supplied. A sensitivity analysis of the effects of different levels of demand and supply elasticities on the relative optimal levels of generic and brand advertising was completed. The effects on the advertising model were evaluated for different levels of product knowledge, product prices and consumer's perception of the informative value of generic and brand advertising.

The model was also utilized to show the effects of the diversity of advertising factors for beef, milk and potatoes. A comparison of the adjustments of the relative levels of generic and brand advertising expenditures under different products prices, levels of product information and consumer's perception of the product attributes was completed.

General Conclusions and Implications

The use of the advertising model to simulate and evaluate the effects of several advertising factors on the levels of generic and advertising expenditures provides the following conclusions and implications:

1. The relative optimal expenditure levels of generic and brand advertising are directly related to the price elasticity of supply. The larger (more elastic) the price elasticity of supply, the larger the relative optimal expenditure levels of both types of advertising.

As the supply becomes less elastic, an increase in advertising produces a relatively larger increase in product price compared to product quantity. Therefore the use of advertising is perceived by the consumer mainly as an increase in product price and will demand relatively smaller advertising expenditures.

2. The relative optimal generic and brand advertising expenditure levels are inversely related to the price elasticity of demand. The larger (more elastic) the price elasticity of demand ($|e_d|$), the smaller the relative optimal expenditure levels of generic and brand advertising. This inverse relationship between $|e_d|$ and the advertising expenditures is explained with the fundamental theorem of Dorfman and Steiner (1954). This theorem shows that as the demand becomes more elastic, the level of advertising decreases to maintain the equality required by a profit-maximizing firm.

Note also that, as the demand becomes more inelastic, the rate of adjustments of the relative levels of both types of advertising gets larger (increases at an increasing rate).

3. Marketing policies oriented toward establishing advertising levels should use relatively less (more) advertising the more inelastic (elastic) the price elasticity of supply and the more elastic (inelastic) the price elasticity of demand.

4. The level of the product information (knowledge) is another important factor determining the advertising expenditure levels. The level of knowledge of a product is inversely related to the level of advertising expenditures. The more the consumer already knows about

the product, the smaller the relative expenditure levels of generic and brand advertising required.

This inverse relationship between the level of product knowledge and the levels of generic and brand advertising expenditures occurs because of the assumption of a finite total amount of product information. The more informed the consumer is about a product, the smaller the amount of product information that can be provided through advertising; therefore, the smaller the quantities of generic and brand advertising needed to reach the optimal advertising levels.

5. The advertising model also shows that the advertising expenditure levels are directly related to the product price. The larger the price of the product, the larger the required levels of both types of advertising.

This direct relationship between the price of the product and the levels of advertising expenditures can be explained using the advertising theorem of Dorfman and Steiner (1954). As the level of advertising increases, the price of the product also increases to maintain the equality of the advertising rule.

6. The advertising model illustrates the relationship between the use of generic and brand advertising when they are used jointly to promote a product. Their relationship is mainly determined by the levels of the generic and brand advertising parameters in the advertising function. These advertising parameters are basically determined by the consumer's perception of the attributes of the product.

The greater the level of product identification, homogeneity, nutritive characteristics, number of uses, and grades and standards for a product, the larger the level of the generic parameter. In contrast, the smaller the level of product identification and homogeneity, the larger the level of the brand parameter. This brand parameter will be relatively larger when attractive packaging is used or when a large number of uses and a well-defined set of grades and standards are in place for a differentiated product.

Even though this study has only used one product attribute (nutritive properties) to obtain a value for the generic parameter, the conclusions about the effects of this advertising parameter on the levels of the advertising expenditures are valid as if all product attributes were included in the process. The reason is that product nutritive properties are a major determinant of the generic advertising parameter.

The larger the generic parameter relative to the brand parameter the larger the ratio of generic to brand advertising expenditures. For example, a product perceived as an easily identifiable, homogeneous and nutritious product will have a larger generic parameter (and a lower brand parameter) and therefore a larger ratio of generic to brand advertising expenditures. This occurs because the attributes of a product are positively reflected through a larger generic advertising parameter while the attributes of a more heterogeneous product is favorable for promoting a brand.

What values to use for the levels of the generic and brand advertising parameters is an empirical question and depends on the

purpose of the analysis and the specific methodology used for obtaining the estimates.

Conclusions on Advertising and Agricultural Products

An arbitrary example of simulating generic and brand advertising in beef, milk and potatoes was included in this study to illustrate the performance of the theoretical advertising model and the responses in the levels of advertising to changes in the model parameters.

Levels of generic and brand advertising expenditures for beef, milk and potatoes were compared using the concept of "wholesome nutritive food" by Williams (1977) to determine the level of the advertising generic parameter while the brand parameter was assumed at the same level for all three products.

Using price elasticities of supply and demand over a range of estimates, the product milk requires smaller generic and brand advertising expenditures and smaller total advertising expenditures than potatoes or beef. This simulated conclusion occurs because milk was assumed to have a relatively lower product price and lower price elasticity of supply than the other two products.

The advertising levels for potatoes are lower than for beef when they are evaluated at their minimum values of supply elasticity and their maximum values of demand elasticity. But when these two products are evaluated at their maximum values of supply elasticity and their minimum values of demand elasticity, the product beef required less advertising than potatoes. This switch in advertising order occurs mainly because the price elasticity of supply is much higher for potatoes (0.80) than for beef (0.50). Still, the advertising levels for

both beef and potatoes are close enough at these elasticities' values due to the relative high price for beef. These simulations clearly illustrate the roles of elasticities in the model in understanding and setting advertising policies.

The advertising model was also utilized to show the combined effects of the prices of the products and the relative effectiveness of generic advertising on advertising expenditures. To accomplish this evaluation, the levels of the price elasticities of supply and demand for all agricultural products were held at the same level as for milk. Under these conditions beef requires the highest levels of advertising among the three products, due primarily to its relative high price ($7.63) and low generic parameter (-0.60, estimated by the wholesome food concept). Milk and potatoes present similar levels of generic and brand advertising because even though the price for potatoes ($2.89) is higher than that for milk ($2.27), the generic parameter for potatoes (-0.72) is greater than for milk (-0.64). That is, relative levels of advertising are pushed up by high product prices but down by high levels of advertising parameters.

Limitations and Research Recommendations

The model developed in this study provides a configuration of the potential effects of generic and brand advertising in agricultural products, where the market consists of only one average representative consumer (X) and one average representative producer (X_j).

Under the assumption of $X^S = X^D$ (total quantity supplied equals total quantity demanded), this advertising model can be extended to a market of many producers and consumers. It might be possible to approximate

the number of consumers and producers and then generate all the necessary derivations of the advertising model in terms of the total market quantity. This model should include the cross effects of advertising among different brands, and any other market effects that occur when the total product market is analyzed. The derivation and interpretation of this market model would be complicated by the increasing number of variables and the larger number of parameters to be estimated (or approximated). Nonetheless, this multiple consumer-producer model of advertising could be used to compare those commodities where the assumptions made at the individual (average producer, average consumer) level translate to a total market.

This study has not addressed the important public policy question of intercommodity substitution potentially created by the use of generic programs in competitive industries. Generic promotion programs that increase domestic consumption of a given agricultural product (in particular, a food product) must accomplish that gain at the expense of other product(s), due to both a limited human capacity for food and a fixed income budget.

It would be interesting to compare the results of the advertising model developed in this study to one where the wholesome food concept of Williams is applied to an average basket of goods bought by a consumer (or household) in the market. For example, it could be the basket of goods utilized to calculate the consumer price index. Such an approach would provide a closer look at the actual behavior of the consumer towards advertising since dietary requirements are usually filled by several products.

Another interesting research area that can be pursued is the introduction of a time-lag element in the advertising model. The advertising effects vary over time for several reasons. It could be due to the very nature of the advertised product (e.g., seasonality of the product) and also because of the different types of messages attributed to generic and brand advertising. Brand programs are usually more direct and their claims focus on specific characteristics; therefore they are expected to have greater immediate responses as consumers experiment with the advertised brand. Generic programs have more of a long-term role promoting the overall product characteristics.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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